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CIVIL ENGINEERING.

On the Retardation and Stoppage of Railway Trains. By Mr. WILLIAM FAIRBAIRN.

The general principle of railway carriage brakes, namely, that of retarding or stopping the revolution of the wheels by the pressure of brake-blocks against their peripheries, is limited in its application to the single carriage in which the power is applied by the guard's hand; and looking at the present greatly increased velocities of trains, and their probable acceleration, it becomes a very important question, whether some more powerful and speedy control is not required over the motion of the train than can be obtained by the ordinary plan of a brake upon one or two guards' vanes, and upon the tender.

Many plans have been proposed, during the progress of the railway system, for the accomplishment of this desirable object; and amongst them may be mentioned, as one of the most practical, a plan invented some years since by Mr. Robert Heath, of Moss-side, near Manchester, which consisted of brake-blocks fixed in slide-bars in each carriage, and worked by a lever with a weight upon the end of it, adjusted to give the requisite pressure upon the wheels. When the pressure of the brakes was required to be taken off, the ends of the levers were lifted by means of a tension-bar and chains, which extended the whole length of the train, and were worked by a rack and pinion within reach of the guard. The

* From Newton's Lond. Journal and Repertory of Arts and Sciences, Aug. 1854.

peculiar feature in this brake, distinguishing it from the ordinary hand-brakes, was the employment of a weight to put on the pressure of the brakes, independently of the power of the man's hand, and simultaneously in every carriage of the train,—giving an important advantage in the great increase of power available for stopping the train, and the promptness of its action; the guard having only to release a catch in order to put on all the brakes at once, and employing his own power only in lifting off the brakes afterwards, by means of the rod and chain communicating with each carriage. In a practical trial of these brakes, in 1848, with a train of five carriages and a van, all fitted with the brakes acting together, and the tender-brake also used, the following results appear to have been obtained:

Speed of Train when Brakes were applied.	Descending gradient.	Distance run after Brakes were applied.
40 miles per hour.	1 in 100	148 yards.
45 " "	1 in 100	163 "
50 " "	1 in 82	232 "
55 " "	1 in 200	264 "

Numerous other plans have been suggested, and tried at different times, for the purpose of arresting the motion of railway-trains within shorter distances than can be effected by the ordinary hand-brakes; but none of them appear to have answered the purpose satisfactorily, or effected any material change in the brakes in general use.

The next improvement requiring particular notice, is the brake recently invented by Mr. James Newall, of Bury,—the more immediate subject of the present paper.

The immense extension of railway communication, and the number of persons conveyed, involve considerations of such vast importance, as to render any attempt to obtain increased security a subject of deep interest, in whatever form or direction that security can be effected. If the causes of the railway accidents which from time to time take place are considered, they may, in many instances, be traced to the inability to bring a train from a state of motion to a state of rest; or, in other words, to the inability to absorb the momentum of the train within a given distance of space, without injury to the carriages, or endangering the safety of the passengers. This has always been a defect in railway traveling, and many of the serious accidents arising from collisions have occurred, from the want of power to stop the train in motion before it arrived at the point of contact.

This, to some extent, has been accomplished by Mr. Newall's brake; and from the results of the experiments made on the East Lancashire railway, on the 7th of November last, as described subsequently, this brake appears to bid fair to accomplish that object, or at all events to become the precursor of further improvements, giving increased security to railway traveling.

The paper contained a detailed account of Mr. Newall's apparatus; but his specification having recently appeared in this Journal (vol. LXIV, p. 31,) we have thought it unnecessary to repeat this description.

The following are the objects obtained by this brake :—1st. A direct communication between the engine-driver and the guard; which communication is always available by either party, in the event of a sudden and unexpected discovery of danger, or obstruction upon the line: this is accomplished, not by ringing a bell or blowing a whistle, where time is lost before the brake can be applied, but by an instantaneous application of the brake itself, or rather, the whole of the brakes, which in every case is the first intimation of the presence of danger, and the remedy to avert its occurrence. This appears to be an important feature in the plan: it is easy of application, and probably the best signal that can be made between two officers of such responsibility as the driver and guard. In the experimental trial of this brake, this was an important feature, and one that could not be mistaken at the moment the brakes were liberated. The check (it could not be called a shock) was so distinctly felt, as to arouse the attention of less vigilant persons than guards and drivers, who are, or should be, constantly on the look-out. 2d. The instantaneous and simultaneous application of the brake to every carriage in the train, and the immediate application of a retarding power to a body of such magnitude as a train in motion, and that without endangering its security, is an advantage of great importance in this plan. The brakes are not screwed against the peripheries of the wheels, as is done in the usual way by the guard in the carriages, and the fireman on the tender; but the whole of the brakes (even if 30 in number) are dropped at once upon the wheels, and, by the expanding force of the springs in the vertical tubes, the effect is such as to act as a signal from the driver to the guard, or, *vice versa*, from him to the driver. No time, therefore, is lost; and the retarding force is in operation upon every carriage at one and the same time; and, by this operation, a few seconds only are required to reduce the velocity and absorb a considerable portion of the momentum of the train. This simultaneous action is therefore of the utmost importance, particularly in the event of a threatened collision, which by this means, if not totally averted, will assuredly be greatly mitigated in its effects. 3d. The power which either the engine-driver or the guard have, together or separately, to sledge the train, or to increase or diminish the pressure on the brakes. In applying this plan of brakes to a railway train, particular care is required, in the first instance, when the train is marshalled, to regulate and adjust the brakes upon each carriage, so as to give neither more nor less than the required pressure. This it will be observed is a constant quantity; and the remaining pressure, when required, must be applied by the driver or guard; and as time is an element in this application, there is the less danger of its being injuriously applied, even when extended to the limit of sledging the train, or stopping all the wheels. This power of application is, however, necessary, as the same amount of friction could not be applied with security to the train by the force of the spring, without incurring risk in the breakage of the wheels or axles.

The following are the particulars of the experiments made upon the East Lancashire Railway, to ascertain the retarding power of Mr. Newall's brake, in stopping railway trains: the train in each case consisting

of 10 carriages, besides the engine and tender, with a gross weight of 88 tons, including the engine and tender.

No. of Experiment.	Descending Gradient.	Speed of Train when Brakes were applied.	Distance run after Brakes were applied.	Remarks.
1	1 in 532	38 miles per hour	218 yards	Rails moist and slippery
2	Level	33 " "	100 "	Bury, rather doubtful
3	1 in 38	45 " "	430 "	Accrington Incline
4	1 in 40	48 " "	371 "	Ditto ditto
5	Level	48 " "	192 "	Blackburn, 2 wheels sledged
6	Level	40 " "	138 "	Ditto, 5 ditto
7	Level	50 " "	310 "	Ditto
8	Level	42 " "	620 "	Blackburn, 3 wheels sledged
9	Level	40 " "	800 "	Ditto

The experiments 1 to 7, were made with eight of the carriages in the train fitted with Newall's brake, besides the ordinary tender brake; and the experiments 8 and 9, were made with ordinary brakes,—two carriages being fitted with them in No. 8, and one in No. 9.

In the experiments 5 to 9, more particular care was taken to ascertain the speed by time and distance; and the moment at which the brakes were to be applied was marked more definitely by the explosion of a detonating signal at the point fixed.

The general result of these experiments appears very favorable to Mr. Newall's brake, as to the efficiency of its retarding power compared with those in ordinary use. At 40 miles an hour, upon a level, with the improved brake, the train was brought up in a distance of 138 yards; but with the ordinary brakes, at 42 miles an hour, 620 yards were run over before the train could be stopped; or, in other words, a railway train can be stopped in one-fourth the distance.

Another plan has been proposed by Mr. Samuel Newton, of Stockport, for attaining the same object of putting on the brakes in the train by self-acting means. To accomplish this, a friction-wheel, 2½ feet in diameter, and 10 inches broad, is fixed on the centre of each axle: this friction wheel is surrounded with an ordinary clamp brake, such as is generally used in connexion with cranes, consisting of an expanding steel ring, lined internally with wood. One end of this brake-ring is fixed to the carriage frame, and to the other end is attached the short arm of a lever; so that when the long arm of the lever is raised, the ring is by this motion enlarged a little in diameter, to allow the friction-wheel to revolve within it without being touched. The long arm of the lever from the front axle approaches that from the hind axle, and both meet under the centre of the carriage: here the levers are joined by a bolt with a slide, so that they may rise and fall together. A weight is then attached; the tendency of which is to depress both levers, and to cause their respective short arms to collapse each brake-ring tightly round the friction-wheel, and thus arrest its revolution, and with it that of the axle and wheels. This is proposed to be the arrangement for every carriage; the weight

on the levers between each pair of wheels being about 120 lbs. By force of gravity, the brakes will apply themselves; and the power to be exerted must be for the purpose of taking them off. This is proposed to be done by the pull of the engine, by means of a metal rod with joints, which passes under all the carriages in a train, and is placed in connexion with the weighted levers. The first end of this rod is to be joined to the tender; and when the engine starts, it will draw out the rod so as to lift up all the levers, and thus release the brakes from the friction-wheels, and keep them clear, so long as the engine continues its tension upon the draw-bar. By this arrangement it is contemplated by the inventor, that, in order to stop the train, it will simply be necessary to arrest the speed of the engine, and the draw-bar will then slide backwards by the action of the weights, which will at the same time depress the levers and apply the brakes.

In another plan for accomplishing a similar object, recently proposed by Mr. Alfred Molson, of London, the application of the brakes is proposed to be effected by means of a brake-bar sliding longitudinally under each carriage, acting on the levers of the brake-blocks, and projecting at each end of the carriage as far as the buffers, so as to come in contact with the ends of the brake-bars of the adjoining carriages.

On a check being given to the engine, and its speed being retarded, by applying the brake to the tender, the hindmost carriages of the train will press on those preceding them; and the springs of the ordinary buffers giving way, the train will be thereby shortened some inches; while the brake-bar of each carriage remaining of its original length, and resisting the advances of the carriages behind, it will follow that the last two or three carriages will have the brakes put on before even the guard in the van has turned the handle of his brake.

The two latter plans not having been yet tried, except in models, no practical results can be given; and they have been named with the view of bringing under the consideration of the members the important subject of the prevention of collisions of railway trains, by increasing the retarding power of the brakes.

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*The Use of Coal in Locomotive Engines.**

The following is a report by Messrs. Woods and Marshall, to the London and North Western Railway Company, on the burning of coal in locomotive engines:

Under the following resolution of the general locomotive committee of the 9th July, we have made a series of experiments on some of the engines of the southern division, with a view to report to you upon the questions submitted to us:

"Resolved,—That Messrs. Woods and Marshall be instructed to make trial of the various sorts of coal in the engines of the southern division, and to report to the next meeting of this committee whether coal can be efficiently and satisfactorily used, in what proportion, and at what cost, as compared with coke."

After conferring with Mr. M'Connell, and with a view to completing our report within the specified time, we judged it expedient to limit our

* From the London Mechanics' Magazine, September 30, 1854.

experiments to the trial of two kinds of coal, and to a comparison of the performances of an engine of the class known as Mr. M'Connell's patent, with those of an engine of the "Bloomer" class.

The Hawksbury coal seemed to be most eligible for use on the southern division, on account of its being procurable at a comparatively low price, in consequence of the proximity of the pits to the main line of the southern division.

The pits are situated on the Coventry and Nuneaton branch, about four miles from Coventry, and yield a coal of hard quality, free from any excess of bituminous matter; and, in other respects, (as, for instance, in freedom from clinker,) favorable for combustion in engine furnaces.

Two qualities of this coal have been submitted by us to trial, viz., Main coal, which is delivered in large blocks free from small coal, and the coal termed "screenings," or "cobbles," which is delivered in small lumps, but free from dust or slack. The prices, as given to us by Mr. M'Connell, are—

Main coal, delivered in contractor's wagons at Rugby, 9*s.* 7½*d.* per ton.
Cobbles, " " " 7*s.* 8½*d.* "

The cobbles are not so hard as the Main coal, and break into smaller fragments when struck by the hammer.

The cobbles can only be supplied in limited quantity.

For the purpose of comparison of the cost of working, it was important to obtain the exact duty of the engine with coke as well as with coal, and our series, therefore, includes the results of several days' work with the best coke we could obtain,—viz., Pease's West coke.

The engine worked alternate days with coke and coal, performing each day 164½ miles, the double journey between Rugby and London.

The performances of the first two days are not here recorded, and may be considered as preliminary. The weather on one of these days was very stormy, and rendered the results of an exceptionable character; and the men had not then acquired the knowledge of the management of a coal fire, which a little further experience gave them.

For six consecutive days (the Sunday excepted) the passenger engine No. 303, Mr. M'Connell's patent, worked the 12·55 P. M. up express train, and the 5·45 P.M. down train, three days with Pease's West coke, and three with the Hawksbury Main coal; these two trains being nearly equal in weight, and presenting little variation during the period.

The details of these, and the subsequent experiments, will be found in the table appended, but the following are the general results:

No. 303 *Engine.*

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
A	Coke	492¾	14·1	31·62	25·34	8·59
B	Coal	492¼	13·2	33·26	35·59	5·78

Deeming it necessary to ascertain the practicability of using coal with heavier trains, we caused the same engine, No. 303, to work the 6·30

A. M. down train and the 11·46 A. M. up train over the same ground. We had one day's experiment with coke, one day with Hawksbury Main coal, and one day with cobbles. The following are the results:—

No. 303 *Engine.*

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
C	Coke	164¼	19·2	29·41	26·80	8·82
D	Main coal	164¼	20·6	28·96	41·66	5·86
E	Cobbles	164¼	29·3	27·76	51·49	5·97

The remaining experiment we have to record is with one of the largest class of the ordinary engines, No. 293, working the 12·55 P.M. up, and 5·45 P.M. down trains, with Hawksbury Main coal. The engine has a large fire-box, with a longitudinal mid-feather and two fire-doors.

No. 293 *Engine.*

Series.	Description of Fuel.	Miles run.	Average Load Carriages.	Average Speed per Hour.	Fuel Consumed per mile.	Water Evaporated per lb. fuel.
				Miles.	lbs.	lbs.
F	Main coal	164¼	14·1	32·96	47·75	4·52

The question of the practicability of burning coal in such locomotives must be answered in the affirmative. The engines had no difficulty in maintaining the required pressure of steam and speed with the trains assigned to them.

II. Taking a general view of all the performances of the engine No. 303 with coal, the consumption, or rather non-production of smoke, was very completely attained.

In the majority of cases, both in traveling and standing, the engine was practically free from smoke, the trace being so slight as to be imperceptible without close examination, and we did not observe in any instance that the smoke emitted could be accounted a nuisance.

From these remarks, we of course exclude the period of lighting the fire and getting up the steam, when the combustion is incomplete, and the production of smoke cannot be avoided.

The non-production of smoke, whilst the engine is working, no doubt depends very much upon the individual skill and care of the engineman and fireman, and demands very close and watchful attention on their parts.

The conditions under which the results related were obtained are as follows:

1. Working with a very thin fire on a large area of grate, and with fire-bars laid much closer together than is necessary for coke. By the large area of grate and thin fire, a large volume of air is enabled to pass through the ignited fuel under a moderate draft.

2. Frequent firing in small quantities to equalize the disengagement of the gases, and thereby prevent the production of a larger quantity at one time than can be saturated by the air passing through a grate or fire-door. This frequency of firing involves much greater care and labor on the part of the fireman. It was found in the trials, that, on an average, the fireman fired four or five times more frequently with a coal, than with a coke fire. Say once in every two or three miles, instead of once in ten or twelve miles.

In throwing on the fuel, the fireman has carefully to observe the state of the fire, that he may throw the fresh coal so as to maintain an uniform covering of the grate; the thickness of fuel ranged from about four to six inches.

3. *Alternate firing.*—The fire-box, divided longitudinally by midfeather into two separate compartments, each provided with a fire-door, gives the means of firing alternately, and thus keeping a bright fire in one box, whilst the other is damped by the addition of black coal.

4. The combustion chamber allows of the mixture of the gaseous products of the two fires with the quantity of free oxygen needful to effect their due saturation, affording space for combustion to take place before the gases pass into the tubes. This arrangement, combined with the double box, renders Mr. M'Connell's engine a more perfect "smoke-consumer" than the common engine.

5. *Quality of the Coal.*—The coals were in lumps of moderate size, to prevent obstruction to the draft, and sudden generation of a large volume of gas, which ensues upon throwing small coal or dust into a bright fire. Hardness in the coal is a quality which tends to diminish the proportion of dust from breakage. The coal should contain as little bituminous matter as may be, and burn with little ash or clinker.

6. Damper, to regulate admission of air to the grate, must be capable of being closed wholly or partially, otherwise smoke will be emitted, and fuel wasted at the stations.

It must be understood that the above were the conditions observed, and apparently required, in working the engine No. 303 efficiently and satisfactorily with coal; but we do not assert that these are invariable conditions as applicable to other engines, the different construction of which might adapt them to burn coal in another way.

The experiment with No. 293 engine did not give so good a result in point of smoke burning; a brownish tint of smoke was pretty constantly observable, but though sometimes very light, was frequently decidedly objectionable.

On the other hand, it is fair to state that the man who drove it had not had much experience in burning coal, which, as may be inferred from our foregoing remarks, requires a management of the fire altogether different from that of a coke fire.

We believe, however, that general experience shows that the ordinary engine is not well adapted for smoke burning, and it is certain, that in the case of No. 293 the smoke-box became overheated by a large accumulation of coal-dust partly ignited.

These effects were altogether absent in No. 303 engine, owing, doubtless, to the large receptacle in front of the tubes, which served to arrest

and detain in the fire-box the smaller particles of coal which otherwise would have passed through the tubes.

III. Relative powers of coke and coal.

The comparison of series A with series B indicates a consumption of coal 40 per cent. greater than that of coke in working similar trains, the average loads and speeds being nearly the same; but the work, as indicated by the consumption of water, being slightly less on the occasions when coal was used.

The comparison of series C and D, with a heavier and slower description of train, gives a consumption of coal 55 per cent. greater than with coke.

Taking the quantity of water as probably the most correct approximate measure of the several resistances, we find the mean duties to be as follows:—

1 lb. coke to 8·65 lbs. water;
1 lb. coal to 5·83 lbs. water;

which show a proportion of 100 lbs. coke as equivalent to 148 lbs. coal, as consumed in No. 303 engine.

We shall, therefore, assume 48 per cent. increase in estimating the relative cost of coal as compared with coke.

The more imperfect performance of No. 293 engine gives a much greater difference, being no less than 90 per cent.

The consumption of coke observed in these experiments accords very closely with the results of the experiments made under similar circumstances, and detailed in our former reports.

From the great excess in the quantity of coal consumed over coke, we are strongly disposed to think there must be something disadvantageous in the construction of the above engines, or in the mode of working them, as regards their applicability for the use of coal as fuel.

This view is confirmed by the results of some experiments made at Wolverton, in the fixed-engine boiler there, with the same qualities of coal and coke, wherein the difference of heating or evaporative power appears to be only 20 per cent., the evaporation being 7·99 lbs. of water per lb. of coke, and 6·77 lbs. of ditto per lb. of coal.

IV. Relative economy in cost of fuel.

The price of the Hawksbury Main coal being assumed at 9s. 7½d. per ton, and the price of Pease's West coke at 21s. 9d. per ton, which is the contract price for the same delivered at Rugby in the contractor's wagons, we may estimate that the cost of a quantity of coal equivalent to one ton of coke will be 14s. 3d., being 9s. 7½d. increased by 48 per cent.

Out of the 21s. 9d. paid for the above coke, we are informed that your Company receive back from the Midland Railway Company, under a special agreement, an allowance of 9d. per ton. This reduces the cost to Company to 21s. per ton.

The saving by use of coal would then be 6s. 9d. per ton., or the difference between 21s. and 14s. 3d.

Upon an annual total consumption of, say 74,000 tons on the southern division, the saving to locomotive power would be £24,975 from this cause.

This, however, assumes that all the engines are of a kind suitable for burning coal, and that no other fuel is used.

As far as our present experience goes, the large engines of the No. 303 class are the only engines on the line in which coal can be practically used without occasioning a nuisance, and these constitute at present but a small proportion of the entire stock.

The expediency of increasing the stock of such engines, for the purpose of effecting, wholly or partially, the saving in cost of fuel which we have indicated, is a question which your Directors will probably not consider within our province at present to discuss, involving as it does so many collateral considerations; also having reference to the general economy of the Company's expenditure—such as cost of engines and the general working expenses.

If the question be entertained as a general one for the whole line, the additional weight of fuel to be transported from place to place, (whether in the wagons or on the tenders,) and the additional number of hands necessary for emptying the wagons and distributing the coal, will occasion expenses which we have not taken into account.

Although we consider the experiments made with No. 303 engine satisfactory in point of smoke burning, we cannot resist the belief that the consumption of coal is in excess of what it ought to be, and that there is room for considerable improvement in this respect by means which shall tend to utilize the heat which is at present wasted.

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*Suggestion for Reducing the Shock in Railway Collisions.**

To the Editor of the Mechanics' Magazine:

Sir,—The greatest part of the mischief which is done in cases of collision on railways seems to be caused by the overturning and piling up of the carriages. If the blow which stops each carriage is not delivered exactly in the centre of gravity,—and it certainly will not be,—there will be a tendency to motion about that centre, either laterally or vertically, and the force being enormously great, either the carriages will turn over on their sides, or will break the coupling chains and be piled up endwise, just as would happen with the links of a chain in motion which should suddenly meet with an obstacle in front; but it will be seen that if the motion of the same chain were destroyed by stopping the last link instead of the first, there would be no such lateral or vertical forces. So also, if the opposing force could be made to strike the last carriage in a train instead of the first, and the coupling-chains were sufficiently strong, the passengers would be thrown forwards violently, but the carriages would remain on the rail, and no injury to the passengers more serious than a severe contusion would be possible.

This I think could be easily effected by having a bar of iron as long as the carriage hung under each of them, capable of sliding freely in the direction of motion. Have one corresponding thereto under the engine, and projecting in front of it as a common buffer, so that these rods may

* From the London Mechanics' Magazine, September 30, 1854.

form a continuous shaft, and communicate the force from one end to the other without affecting the carriages. When the train is made up, fix a cross-bar to the axis of the last carriage, and let the end of the proposed bar butt against it. In the event of a collision the coupling chains may break, but the greatest part of the momentum would have been destroyed before the ordinary blow is given. If there is no great objection to having this bar projecting for several feet beyond the front of the engine, each of the rods in question might be furnished with a common spring-buffer end, so that the force would be received by as many springs as there are carriages in the train, instead of by the single engine buffer, as is now the case. Perhaps, Sir, some of your practical correspondents may see a means of carrying this notion into effect, or will otherwise be good enough to point out the difficulty in doing so.

I remain, Sir, yours, &c., N. B.

AMERICAN PATENTS.

List of American Patents which issued from Sept. 5th, to Oct. 3d, 1854, (*inclusive.*) *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

SEPTEMBER 5.

1. For an *Improved Mill Stone Dress for Cleaning Grain;* W. Ager, Rhorsburgh, Pa.

Claim.—"I claim the dress, consisting entirely of cracks, having inclinations for causing reverse drafts, so as to turn the grain and revolve it both on its longest and shortest axes, for cleaning and scouring said grain."

2. For an *Improvement in Flour Bolts;* Wm. H. Akins, Ithaca, New York.

Claim.—"I claim the connecting rod, in combination with the vibrating bracket and pulley over which a belt passes, said bracket being secured to an axle, for serving the double purpose of giving the bolt a short, quick, horizontal vibrating motion, and at the same time give it a rotary motion."

3. For an *Improvement in Spring Rollers for Window Curtains, &c.;* Benjamin Bray, Salem, Massachusetts.

Claim.—"I claim providing the tubular or hollow curtain roller with a long spiral spring within it, when said spring is used for the purpose not merely of drawing up the curtain by its recoil, as that is not new; but of balancing it in any position in which it may be placed."

4. For an *Improvement in Attaching Pulleys to Shafts;* C. Clareni, City of N. York.

"The nature of my improvement consists in casting a recess in the pulley, one portion of such recess being deeper than the other, and in placing therein a small roller, in such a manner that when the pulley is placed upon the shaft, it will bind and become a tight pulley when the shaft revolves in one direction, and loosen when the shaft is turned the reverse."

Claim.—"I claim the method of fastening pulleys to shafts, by having a cam cavity or recess in the pulley, and introducing therein a roller, as set forth."

5. For an *Improvement in Chimney Caps;* John Clark, Washington, D. C.

Claim.—"I claim constructing chimney caps having balance compensating valves, with lever and weight, or its equivalent, together with the valve opening at the top, whereby is prevented the undue accumulation of smoke within the space, thus affording the speedy escape of the smoke in its ascent upward through the chimney."

6. For an *Improvement in Seed Planters;* Charles H. Dana, West Lebanon, N. H.

Claim.—"I claim the staff and the reciprocating seeding box and apparatus, arranged in such a manner that the reciprocating movement of the seeding box and apparatus be upon one side or face only of its staff, will cause the seeds to be deposited by means of the measuring cavity in the staff, in connexion with the depositing cavity and the brush or elastic partition of the seeding apparatus, or their equivalents, combined and operating with each other. Also, the triangular measuring cavity in the staff, in connexion with the brush or elastic partition, and the depositing cavity of the seeding apparatus, arranged and operating to deposit the seeds, by means of the reciprocating movement of the seeding box, and being upon one side or face only of its said staff."

7. For an *Improvement in Seed Planters;* Louis Daser, Washington, D. C.

Claim.—"I claim the seeder, cut, and slot, in combination with the drill, the flared hole, spring, and cylinder."

8. For an *Improvement in Making Ribbon of Strips of Cloth;* Augustus M. Eastman, City of New York.

"The nature of my invention is to form upon the edge of narrow strips of velvet which are torn from broad pieces of 'broad yards,' made of any material from which velvet is woven, an artificial selvedge, which will exactly imitate a woven selvedge, and possess all the qualities of the woven selvedge."

Claim.—"I claim forming upon the edges of strips of velvet a firm artificial selvedge, by means of a brush or cushion, charged with a suitable adhesive compound."

9. For an *Improved Arrangement of Reefing and Furling Sails from the Deck of the Vessel;* William H. Foster, Portsmouth, New Hampshire.

"The nature of my invention consists in bending the sail to jack stays made fast on batten which I attach to and along the fore side of the yard, or on the back side thereof, if preferred, and in providing one or more reef bands, bolt or other ropes, or both, if necessary, to extend horizontally on the back of the sail at such distances below the yard as may be needed for each reef."

Claim.—"I claim the arrangement of the jack stay and batten with the main and minor reefing lines, furling or spilling lines, the line for manœuvring the dogs' ears, with the necessary sheaves and blocks, whereby the square sails of a vessel may be reefed and furled by the lowering of the yard, from the deck of the vessel."

10. For an *Improvement in Machinery for Worming Rigging;* Jonathan C. Ginn, South Thomaston, Maine.

Claim.—"I claim the combination and arrangement of the helical traveler, the box or tubular frame, and the bobbins or reels, composing a hand machine."

11. For an *Improved Portable Door Fastener;* Geo. W. Griswold, Carbondale, Pa.

Claim.—"I claim a portable or removable door fastener made in one piece, and having two or more arms at right angles to each other, with one serrated and one smooth edge, so that when either of said arms are introduced into the crack between the door and its frame, and turned one-quarter round, its teeth will be pressed into the frame, and the smooth edge of one of the other arms will be brought against the door, to prevent it from being opened."

12. For an *Improvement in Machines for Breaking Flax and Hemp;* John Hinde, Schenectady, New York.

"This invention consists in passing the flax, hemp, or other material, between a ribbed or fluted sheet or endless apron, and a series of fluted rollers which have a rolling and vibrating motion over its surface. The action of this sheet or apron and the rollers, is intended to resemble the action of the human fingers in rubbing and divesting the material of its boon or woody substance. I do not limit my invention to the employment of the apron and rollers, in connexion with the pairs of fluted and screw rollers, but intend to use them either alone or connected with any other apparatus for performing a preparatory breaking operation."

Claim.—"I claim the employment of a moving ribbed sheet or endless apron with a series of rollers working upon it. Also, giving to the said rollers a reciprocating motion backwards and forwards upon the sheet or apron."

13. For an *Improved Method of Hanging Plane Stocks;* M. G. Hubbard, City of N. Y.

"My improvement consists of the double set of planes having a movable bed between them supported against rollers for carrying forward the stuff to be planed without returning it back to its original place of entrance, or two boards planed at the same time, by which much time, friction, and power are saved for a given amount of work done."

Claim.—"I claim the mode of suspending the plane stocks below the edge of the plane, by which I increase the pressure on the heel of the stock as the resistance increases, and decrease the size of the springs and the amount of friction attendant thereon. Also, the gauge for preventing the insertion of a board of improper thickness."

14. For an *Improved Riving Machine;* Adoniram Kendall, Cleveland, Ohio.

Claim.—"I claim, 1st, The sliding knife, brace, springs, driving arms, the upper arm being separated from the lower, and the planes for raising the upper arm from the knife while the lower arm passes under. The several parts named, I claim, in combination, for the purpose of cutting a block from a bolt, and conveying it to the knife to be divided into two blocks ready to be carried forward by the drivers, to be again divided by the knives. 2d, The combination of the upper springs, the lower springs, knives, and the reciprocating drivers, for the purpose of conveying the blocks divided by the knife, from it to the knives, by which they are again divided. 3d, The two side pieces provided with grooves or channels, with the tumbler, the middle channels being of such inclination that the drivers ascend in passing from the knife, and return by means of the tumbler in the channel. The driver descends in passing from the knife, and returns in the channel, and is thrown up in place by the springs. I claim, also, the combination of the grate plates with the tumblers and springs, or other equivalent devices, for the purpose of giving the proper direction to the reciprocating drivers."

15. For *Improved Driving Wheels of Locomotives for Ascending Inclined Planes;* J. Morss, Washington, District of Columbia.

"The nature of my invention consists in the use or employment of elliptic driving wheels on locomotive engines, in connexion with curved rails, by means of which a locomotive of sufficient power is enabled to draw a much greater load up a much steeper grade than it can overcome upon the usual plan, without reference to its weight or vertical pressure upon the track."

Claim.—"I claim the use or employment of inclined driving wheels upon locomotive engines, or their equivalents, in combination with the curved rails."

16. For an *Improvement in Ice Cream Freezers;* Thomas M. Powell, Baltimore, Md.

Claim.—"I claim the manner of constructing ice cream freezers with three or more cylinders, arranged for the purpose of more speedily and effectually freezing the cream."

17. For an *Improvement in Tables;* Charles Rowland, Belleville, Illinois.

Claim.—"I claim constructing the supports of the table so as to form seats capable of being closed and withdrawn."

18. For an *Improved Machine for Feeding Paper to Printing Presses;* Bradford A. Rugg and Ezra H. Benjamin, Oak Hill, New York.

"The nature of our invention consists in providing a series of rollers and endless aprons, so arranged that by placing the paper between the aprons the sheets shall be separated and delivered, one by one, into the printing press with as much rapidity as desired."

Claim.—"We claim the combination of one or more endless aprons in such a manner that the sheets of paper in approaching the printing cylinders, shall be rolled around a roller, and thus caused to overlap each other. 2d, We claim the combination of the dropping board with the apron, in the manner set forth."

19. For an *Improvement in Machinery for Dressing Flax;* Daniel Warner, Jr., South Hadley, Massachusetts.

Claim.—"I claim the construction and arrangement of the heckling and scutching drums; that is to say, drums having a series of heckling bars, or bars armed with teeth, set at an angle with the radius, in combination with the blunt-edged or scutching bars, and the drums so made arranged in two rows, one above the other, with the centres of their shafts diagonally placed, so as to cause the flax, in passing between, to be acted upon by both sets of drums."

20. For an *Improvement in Stringed Musical Instruments;* G. L. Wild, Baltimore, Md.

Claim.—"What I claim does not consist simply in the employment of screws, or their equivalents, for tuning and keeping stringed musical instruments in tune; neither do I claim any particular shape, arrangement, or form; but I claim, 1st, The employment of the supporting projection, or its equivalents, of the tuning screw, for the purpose set forth. 2d, The use of the slot and guides, or their equivalents, for the purpose described. 3d, The bridle, or its equivalents, operated by the harmonizing screw, or its equivalents, for the purpose specified."

21. For an *Improvement in Doors for Baggage Cars;* Henry L. Clark, La Port, Ind.

Claim.—"I claim having the door placed between ways which are secured to the side of the car by hinges, and forcing the door outward by the device shown, or its equivalent, so as to cause the outer ends of the hinged ways to be in contact with stationary ways, between which said door is shoved when opened."

22. For an *Improvement in Railway Lamps;* Leroy S. White, Chicopee, Mass., Assignor to self, Lewis White, Hartford, Conn., Lyman White, Springfield, Mass., and Augustus G. Stevens, Manchester, New Hampshire.

Claim.—"I do not claim the employment of a tube or passage descending through the burner so as to admit air to the interior of the wick tube and flame; but what I do claim is, the arrangement of the filling orifice and the air tube leading out of the closed secondary oil and carbon receiver or chamber under the wick tube, such arrangement consisting in placing the filling orifice on the upper part, and at or near one end of the lamp, and carrying the oil tube in an inclined direction through the main oil chamber, and out of the top thereof, whereby the contents of the secondary oil receiver may be emptied from the said receiver and through the tube, without danger of spilling the contents of the main oil receiver out of the filling orifice thereof."

23. For an *Improvement in Brick Presses;* A. H. Brown, Georgetown, D. C.

Claim.—"I claim, 1st, The peculiar construction, each separate frame or link in the chain of moulds forming a part of two moulds, the projecting plate, as the moulds pass over the first octagon, closing so as to form the bottom of the preceding frame and the side, closing against the ends of the preceding frame so as to form a perfect mould when the chain is horizontal; as the frames pass over the second octagon, the sides and the ends releasing themselves from the plate of the preceding frame, leaving the brick free upon the plate, so that it may be easily discharged, the lugs gearing into the octagons for propelling the moulds. 2d, I claim, for the purpose of compressing dry clay into bricks, the combination of the two plungers with the cams, the cams revolving and the plungers moving in unison, the first cam having the longest radius, and causing the first plunger to descend the greatest distance upon the easily compressible clay, the second cam which actuates the plunger having a smaller radius than the first cam, so that the greatest force of compression is applied to the clay already partially compressed where the greatest power is required."

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24. For an *Improvement in Machines for Cleaning Wool;* Leander W. Boynton, South Coventry, Connecticut.

Claim.—"I claim the combination of the cylinder with the hollow or mandrel, when these are combined with the horizontal vat, divided into two or more apartments."

25. For *Apparatus for Turning the Leaves of Books;* Hezekiah C. Bridgham, New London, and James M. Stewart, Norwich, Connecticut.

Claim.—"We claim, 1st, The combination and arrangement of the lever, pawl, ratchet wheel, and pin roller, or their equivalents, so constructed and operated as to raise the pawls in succession, and allow the fingers to turn the leaves of a book, as required. 2d, The combination and arrangement which operates the fingers separately, when the leaves of a book are turned back to repeat a portion of the tune, in combination with the apparatus which operates the fingers successively, the apparatus which operates the fingers separately, when used in repeating, being so constructed and arranged as not to derange the apparatus which operates the fingers successively. 3d, Making one fork of the fingers elastic, or operating it with a spring so as to gripe the leaf of a book when placed between said forks."

26. For *Improvements in Surface Condensers for Marine Engines;* Daniel Carpenter, Brooklyn, New York.

Claim.—"I do not claim, broadly, the use of a perforated plate in combination with the tubes of a surface condenser; nor do I claim, broadly, the use of clamp plates for clamping tubes; but I am not aware that several series of tubes have been bound together by outside clamps and interposed groove bars, to bind all the tubes together in all directions. What I claim in a surface condenser, in which the steam to be condensed is made to pass outside of the tubes, is, putting the tubes close together by making the two ends of the tubes which pass through holes in the tube sheet of a smaller diameter than the body of the tubes, and securing them in place by means of nuts tapped on to the ends thus reduced. Also, in combination with a congeries or set of tubes, arranged to constitute a surface condenser, which effects the condensation of the steam outside of the said tubes, a guard plate or plates with apertures between the exhaust port or inlet for the steam, and the side or sides of the set of tubes, for the purpose of protecting the tubes from the violent concussions of the steam when entering. And I also claim, as a means of resisting shocks and preventing the vibration of the tubes of a condenser, the employment, in combination, of the outside clamp bars and interposed bars grooved to embrace the tubes, so that when bound together they shall be firmly held to resist all lateral motion or vibration, whilst at the same time the clamps and interposed bars will further act as diaphragms to direct the steam across the set of tubes."

27. For an *Improvement in Boots and Shoes;* Nathaniel Colver, Detroit, Michigan.

Claim.—"I claim the construction of boots and shoes, (with uppers as now constructed in the United States,) with a wooden instead of a leather sole or bottom attached to the leather uppers, as described."

28. For an *Improvement in Metallic Slat Shutters;* John B. Cornell, City of N. Y.

Claim.—"I claim the manner of uniting the sheet metal slats of the shutter by swaging the edges of the slats into forms of corresponding segments of circles, and connecting them by means of hinged bars combined with said slats, and arranged in such a manner that the pivots of said hinges will be concentric with the segmental curves of the edges of the slats, and also cause the flat portions of said slats, when the shuttle is open, to be directly in line with each other."

29. For an *Improvement in Oscillating Engines;* Wm. Craig, City of New York.

Claim.—"I claim the steam pipe or valve, operated by means of the eccentric rod for obtaining a double action, in combination with the follower and trunnion of an oscillating steam engine, for the purpose of admitting steam into the face of the trunnion without regard to size of parts. Also, the mode of arranging the eduction and induction ports without regard to size."

30. For an *Improvement in Mill Stone Dress;* P. Dickson, Woodcock Township, Pa.

Claim.—"I claim the dividing the face of the runner and bed stone, into three circular courses of furrows, all the furrows in A B having the same draft, and having twice the number of furrows in B C than there is in A B, and giving these furrows the same draft in respect to themselves, but a different draft from the furrows in A B, in combination with the furrows in the third course, C D, to operate as conveyors, in the manner described."

31. For an *Improved Piston or Valve for Rotary Pumps, &c.;* J. Gatley, Rome, N. Y.

Claim.—"I claim the use of a frame filled with friction rollers to move with the sliding piston, embracing, also, the method of interlocking, as described, or substantially the same. Also, the modification to adapt my arrangement, meanwhile maintaining the requisite efficiency to any purpose where motion is to be communicated through the revolution of the arms, wings, or vanes, the two opposite extremities varied in their relative length by means of an eccentric cylinder or ring."

32. For an *Improvement in Straw Cutters;* Warren Gale, Troy, New York.

Claim.—"I claim the arranging the flanch or flanches on one cylinder, so that they will meet the knife or knives on the other cylinder, as the two cylinders rotate. Also, in combination with the flanched cylinders, the throat placed in such relative position to said flanched cylinders as to nearly meet the latter at a desired point in their revolution, thus assisting to give a long cut, if said throat be expanded, and a short cut when the throat is contracted."

33. For an *Improvement in Coupling for Carriages;* Abram J. Gibson, Clinton, Mass.

Claim.—"I claim the employment of a cylindrical bar of iron, having a threaded bolt projecting downwards, and working in a threaded cylinder on the forward axle. Also, in combination with the cylindrical bar of iron, the manner of connecting the rear with the forward axle, by means of a thread bolt formed at the connexion of the rods or perches, and working in a threaded chamber cut in the cylindrical bar."

34. For an *Improvement in Ventilating Ship Timbers;* Joseph L. Harley and Samuel Maxwell, Baltimore, Maryland.

Claim.—"We claim a ventilator, consisting of the tube, cap fitting thereon, sustained by means of the double acting spring on the stem, by which the cap is kept open, or securely closed when down."

35. For an *Improvement in Trusses;* Seymour N. Marsh, City of New York.

Claim.—"I claim, 1st, The ring pad to close the external and internal abdominal rings, by making pressure specially upon those parts, and not over the entire external surface of the canal. 2d, The interior ball pad, combined with the ring pad, for the purpose of producing upon the inguinal canal, a pressure for the purpose of creating adhesive inflammation, which pressure is entirely independent of the pressure upon the ring pad, and the consequent resistance of the abdomen of the patient, and which is capable of being regulated by a screw, or other equivalent means provided for the purpose."

36. For an *Improved Method of Applying Heat to Dilate Gases, for the purpose of Elevating Water;* John W. Middleton, Philadelphia, Pennsylvania.

Claim.—"I make no claims to elevating fluids by the dilation or contraction of gaseous media, whether by natural or artificial heat; but what I do claim is, the method herein described and represented, of applying heat to elevate water."

37. For an *Improvement in Corn Shellers;* G. Maynard, Greenfield, Massachusetts.

Claim.—"I claim the arrangement whereby two shelling wheels, with their axis parallel, turning in opposite directions, are made to operate simultaneously upon one ear of corn, the ear being fed in between the said wheels."

38. For an *Improvement in Cooking Stoves and Ranges;* J. MacGregor, Jr., City of N. Y.

Claim.—"I claim having a flue or flues surrounding the oven or ovens."

39. For an *Improved Regulator for Gas Burners;* Andrew Mayer, Philadelphia, Pa.

Claim.—"I do not claim the employment of a conical valve to regulate the flow of gas, irrespective of the peculiar construction of the said valve; but I do claim the employment of a hollow conical valve perforated at its apex, and having openings around its base, and being arranged with a box which receives the gas through an opening under the valve."

40. For an *Improved Apparatus for Distributing Fluids;* John W. Middleton, Philadelphia, Pennsylvania.

Claim.—"I claim the arrangement of a water reservoir and air vessel between the service pipe and the distributing cocks, or near the latter. Also, the vertical pipe, water and pressure gauge, to regulate the flow of fluid through pipes."

41. For an *Improvement in Apparatus for Determining the Weight of Cargoes in Vessels;* Ephraim Morris, South Bergen, New Jersey.

Claim.—"I claim, 1st, Determining the level of the water, and the consequent weight of the cargo, by means of a plunger, hollow rod, glass tube and bulb, applied to the tube containing the water. 2d, The adjustable socket with an index marked thereon, in combination with a hollow rod and plunger, whereby the apparatus is adapted to different boats of the same size, or to the same boat under various circumstances."

42. For an *Improved Spoke Machine;* Newell North, Stow Township, Ohio.

Claim.—"I claim, 1st, The index and cam crank, in combination with the forked centre or holder, and the carriage, or their equivalents. 2d, The combination of the handle and rod, and lever and poppet centre, and adjustable cross bar and screws, the same being combined with the carriage frame and guides. 3d, The arrangement or relative position of the cutters with respect to the set of cutters. 4th, The support or standard and springs, or their equivalents, combined as described. 5th, The combina-

tion of the set of cutters, or any equivalent combination, for the purpose of planing two sides and one edge of the spoke, with the one and the same set of cutters."

43. For an *Improvement in Breech Loading Cannon;* Wm. E. Osborn, Milton, N. Y.

Claim.—"I claim, 1st, The eccentric or cam shaped piece set on trunnions, so that the operation of rotating said breech piece on its trunnions, by a lever or any suitable means, compresses the curved surface of said breech piece against the rear of the bore or calibre of the gun. 2d, Removing said breech piece from the line of the bore or calibre of said gun by rotating said breech in the reverse direction, causing the cam or projection, or its equivalent, to act as a fulcrum, on which said breech is lifted by the one operation of rotating the breech, the trunnions sliding up in the grooves. 3d, The construction and arrangement of the hammer and nipple, whereby the hammer is cocked by its own weight, for the purpose specified."

44. For an *Improvement in Tailor's Sheers;* Joseph Phares, Cincinnati, Ohio.

Claim.—"I claim, 1st, The placing of the rivet of tailor's shears outside of the angle formed by prolonging the directions of the cutting edges, for the purpose of giving to the cutting point of the edge an oblique backward motion, thereby increasing the ease of cutting, diminishing the resistance to working the shears and bringing the cutting points nearer the hand. 2d, Combining with this the guide, a stud set in one blade working in a curved slot in the other, having a screw thread cut on it, on which is placed a rivet head nut, or other equivalent device, for the purpose of steadying the motion of the edges, and more effectually securing them from spreading in working."

45. For an *Improvement in Sewing Machines;* Philander Shaw, Abington, Mass.

Claim.—"I claim the combination, applied to the shaft for imparting to it an intermittent rotary motion, so as to obtain the length of stitch, as specified, such combination consisting of the cam, the wheel, the movable or sliding box, or its mechanical equivalent, and the spring applied together and to the shafts, and made to operate."

46. For an *Improvement in Portable Grist Mills;* Samuel Sheldon, Cincinnati, Ohio.

Claim.—"I claim securing the stationary stone to an upright flanched plate, and the adjustment of said plate by means of slotted flanches and bolts, for insuring in a simple and effectual manner, the parallelism of the faces of the stones, when the same is applied to a mill in which the axis of revolution of the running stone is horizontal."

47. For an *Improvement in Palate for Artificial Teeth;* L. Simonds, Boston, Mass.

Claim.—"I claim attaching to an artificial palate, or to any plate to be secured in the mouth, an air chamber, constructed with a flexible elastic diaphragm, for more effectually exhausting the air between the artificial palate and the roof of the mouth."

48. For an *Improvement in Curtain Fixtures;* D. Carlos, Smart, Cambridgeport, Mass.

Claim.—"I claim the combining the centre pin of the curtain roller with the roller, by means of a screw, and making the pin with a head, by which it may be revolved, the same enabling me not only to dispense with the usual counter-balancing weight necessary for the window shade or curtain, but to form in the window frame the female centres or bearing holes by the pressure of the screw, and thereby I dispense with the usual socket pieces generally applied to the window frame for supporting the roller."

49. For a *Mode of Operating Fire Engines;* F. G. Smith, Columbia, Tennessee.

Claim.—"I claim constructing fire engines with springs, in any manner substantially the same as hereinbefore set forth, and for the purpose specified."

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50. For an *Improvement in Breech Loading Fire Arms;* H. W. Adams, City of N. Y.

Claim.—"1st, Though I do not claim the breech roller having a passage through it so that when placed in one position in the chamber which receives it, it will form a prolongation of the bore, and when placed in another position will close the rear end of the bore; I claim the combination with the said roller, of the common gun nippie, said nipple being inserted at one end of the said roller which projects outwardly from the said chamber, and communicating with a vent bored to the surface of the central solid part of the said roller, which covers the end of the barrel, so as to convey fire from the nipple to the centre of the charge in front of the roller. 2d, Though I do not claim the employment of a groove or grooves, as made in the charge holder of Alonzo D. Perry, I do

claim forming a cavity or space within the chamber which contains the breech roller, when the said cavity extends all round the said roller, and so nearly from end to end thereof as to leave only sufficient bearing at the ends to keep the said roller in proper place, and is for the purpose of reducing the friction of the roller, and for the prevention of its sticking tight in the chamber. 3d, Fitting the opening in the rear part of the breech supporter with a tube, which enters the space between the breech roller and its seat and fits closely up to the roller, serving the double purpose of giving the roller a bearing opposite to where the force of the explosion of the charge acts upon it, and of preventing the escape of the fire or gas through the back of the breech supporter. 4th, The chamber detached from the barrel and fitting into the breech supporter, so as to be incapable of turning therein, but to be capable of being forced up towards or into closer contact with the breech roller, by the screwing in of the barrel."

51. For an *Improvement in Machines for Dressing Mill Stones;* Elliot C. Badger, Warner, New Hampshire.

"The nature of my invention may be thus described: 1st, I attach a bevel gear wheel to the mill spindle which turns a pinion and shaft, to which a cam is attached, and that operates and gives motion to the chisel, or other tool which is used for furrowing mill stones."

Claim.—"What I claim is, the guide, with the narrow slot in a straight line, or such curve as is desired to give the furrow in which a projection from the frame carrying the pick works, and by which the pick is guided, as it is drawn out to cut the furrow desired, and this either with or without the thread screw, by which said guide is moved radially around the cylinder and spindle."

52. For an *Improvement in Steam Engines;* W. Black, Allegheny, Pennsylvania.

Claim.—"I do not claim forcing unmixed water with a highly heated cylinder, as that mode is shown and described in Mech. Mag., vol. v., p. 1; nor do I claim re-heating and re-densifying steam that has been used in one cylinder to expand and use it in another cylinder of larger size, as this is set forth in a patent granted to James Frost, in 1841; nor do I claim having discovered a new principle in super heating steam apart from water, such as is set forth in an application for a patent by James Frost, in 1845; nor do I claim the discovery of a mode of creating power by super heating steam as it passes between two engines, one low and one high pressure; nor to have invented a mode of using the spent or free steam for cooling and warming water, as set forth in an application for a patent, by James Frost, in 1849; nor do I claim using the highly heated air as a motor, or for generating steam by passing highly heated air through water as it falls from one shelf to another; such was done by De Rosen, and is described in Newton's London Journal, vol. i, 2d Ed., page 156; but what I do claim is, the mixing, by means of a revolving brush, or some other mechanical equivalent, small drops or particles of water in the steam. Also, the immersing the ramming chambers or pumps in water, or its equivalent, for the purpose of chilling the saturated steam suddenly, and just before it is forced into the heated cylinder. Also, the ramming or forcing the highly saturated steam into the heated cylinders in the manner set forth."

53. For an *Improvement in Maize Harvesters;* James S. Burnham, West Jefferson, O.

Claim.—"I claim the employment and arrangement of the oblique self-adjusting, cutting, and sustaining platform, having a flanch on its back edge, and cutters arranged or formed on its front edge near either end. Also, the employment of the horizontal collecting reels, having their arms made elastic and of cima reversa shape, in combination with the guards, oblique fenders, guides, and receivers or bundlers. The arrangement of the receiver arms or bundlers, moved by the shifting lever and connecting rod, for the purpose of readily effecting the discharge of the stalks."

54. For a *Method of Sawing Shingles;* C. J. Conrad, Lower Augusta Township, Pa.

Claim.—"I claim the use or employment of the notched register plates, one being constructed with equi-distant notches, the other with notches placed alternately at about three-fourths and one-fourth of the distances of the first mentioned, in combination with the register frame, its counterpoise weight, and the levers."

55. For an *Improvement in Telegraphic Keys;* John Davis, New Bedford, Mass.

Claim.—"I do not confine my invention solely to the producing of the dots and marks which Morse uses in operating his telegraphic register; any arrangement may be produced; neither do I confine my invention to the operating of Morse's telegraphic regis-

ter; it may be applied to any telegraphic registering apparatus where spaces, dots, long and short marks are used for transmitting and recording information by telegraph; neither do I confine my invention to the working of the respective slide with its pinion and rack; it may be operated by passing the slide against the shaft or roll friction, producing the same as the rack; neither do I confine my invention to the spiral spring; any other may be used. What I do claim is, the construction of a bank of telegraphic keys, operated by their respective pinions, or by a roll with or without teeth, said pinions or roll may be operated by clock work, or by any known motor, and thereby operating the well known magnetic lever, causing the connexions of the battery circuit to be completed and broken a succession of times by a single operation of the operator, said connexions to be of a longer or shorter duration, as the respective symbol on the respective slide shall indicate."

56. For an *Improvement in Bee Hives;* Henry Eddy, M. D., North Bridgewater, Mass.

Claim.—"I claim nothing original in dividing the hive into upper and lower apartments, nor the insertion of panes of glass in the sides of such apartments; but what I claim is, the arrangement of metallic protectors in a movable slide or bottom."

57. For an *Improvement in Making Slag Ware;* William Gilbert Elliott, Blisworth, England; patented in England, Oct. 5, 1852.

Claim.—"I claim the improvement in the manufacture of bricks, pipes, tiles, and other articles capable of being moulded from slag, (or from a liquid mass analogous to slag,) in a melted or fused state, such improvement consisting in expelling the gases of the slag by piercing and pressure at the same time, when the slag is in a mould."

58. For a *Sewing Machine;* Benjamin Fulghum, Richmond, Indiana.

Claim.—"I claim sawing timber by placing a saw within a carriage attached to frames jointed or connected together, and operating in the manner described."

59. For an *Improved Portable Staging;* William P. Goolman and Samuel Morris, Springtown, Indiana.

Claim.—"We claim, 1st, Conducting the rope which supports the platform, G, to the platform, G′, fastening it thereto, so that the workmen on the platform, G′, can traverse both platforms simultaneously, in either direction. 2d, Connecting the bars of the connecting bridge with hinges, so that they may be folded to use part of its length, or so as to occupy a shorter space in transporting from place to place. 3d, The additional links so constructed, arranged, and connected with the other links as to sustain and support the bars or rails of the bridge, when the bars are swung round to shorten said bridge."

60. For an *Improvement in Vault Lights;* Thaddeus Hyatt, City of New York.

Claim.—"I claim the making a vault cover by the union of two metal pieces, of which one is formed as a grating, and the other is formed with an opening whose area is at least equal to the combined area of all the openings in the grating, (the area of the one being covered over by the grate bars of the other,) in combination with a glass or layers of glass, protected by the grating and covering the opening of the metal frame in which they are set."

61. For an *Improvement in Air Engines;* James R. Napier, Glasgow, and William J. Macquorn, United Kingdom of Great Britain and Ireland; patented in England, June 9th, 1853.

Claim.—"We make no claim to any of the mechanical parts separately; but we claim, 1st, The adaptation of a heat screen, the form of which may be varied, and the means of giving motion thereto may also be varied; the said heat screen being separate and distinct from the plunger which drives the air or other gas from the hot to the cold end of the receiver, and vice versa, and being adapted to the following purposes: 1st, To screen the principal portions of the air or other gas from the communication of heat from the furnace or source of heat at those times when that heat would impede the motion of the engine, that is to say, when the air or other gas is being passed towards the cold end of the receiver to be cooled, when it is not being expanded, and when it is being compressed. 2d, To receive and store up in its own material at such times, the heat communicated from the furnace. 3d, To permit and accelerate the communication of heat to the air or other gas, at the time when it is most effective in developing mechanical power, that is to say, when the air or other gas is being expanded. We claim the adaptation of tubular receivers, for the purpose of heating and cooling the air or

other gas, by the aid of rod-shaped heat screens or plungers, nearly filling the tubes, and serving, by being moved out and in, whether by the mechanism shown in the drawing, or by any other suitable mechanism, to admit and expel the air or other gas, and promote its circulation over the heated or cooled surface. We do not claim the invention of tubes as a means of increasing heat conducting surface; but simply the adaptation of tubes to engines worked by the action of heat on air or other gas, by the aid of the rod-shaped heat screens or plungers."

62. For *Tidal or Current Hydraulic Ram;* J. W. Middleton, Philadelphia, Penna.

Claim.—"I claim the combination of a weighted lever or float with a series of narrow strips, each hinged at or near its middle, so that the pressure of the water above and below the hinge may be nearly equal, these strips being arranged across the lower end of the tube to close and open it alternately. Also, the arrangement of the strips in a curve, and turning them in the act of opening different distances to keep them parallel to each other, thereby permitting the water to flow more freely."

63. For *Fire Arm;* Wm. H. Morrison, County of Marion, Indiana.

Claim.—"I claim, 1st, The arrangement of the turning lever, and the manner in which it is made to turn the revolving cylinder, and of the plate behind the cylinder on which the turning lever operates. 2d, The arrangement and combination of the levers, by which the catch, that arrests the revolution of the cylinder, is operated on, and the manner in which these levers are worked by the turning lever. 3d, The arrangements by which the revolving cylinder is thrown out to the side so as to clear the barrel in loading, without detaching the former from the gun. 4th, The use of the cutter at the bottom of the bore of the barrel for opening the cartridges. And I claim the use of such a cutter, whether of the particular shape herein described, or not."

64. For a *Mode of Constructing the Backs of Car Seats into Beds or Lounges;* Henry B. Myer, Buffalo, New York.

Claim.—"I claim the construction or formation of beds or lounges on the backs of railroad car seats, by turning them up to and retaining them in a horizontal position, and so arranging the backs of contiguous seats that they may meet and remain in the same horizontal plane by the methods herein described."

65. For *Breech Loading Fire Arms;* Abner N. Newton, Richmond, Indiana.

Claim.—"I claim, 1st, Constructing the breech with a hinged lip, which fits to a recess in the chamber, and receives the charge when the breech is drawn back, but forms part of the chamber when the breech is in place for firing, and which, when the breech is moving back and forth, is capable of a slight vibration to compensate for any want of truth in the breech or its fittings, and to enable itself to rise from the floor of the recess in the chamber to be supported by a friction roller in running back and forth, but to bed firmly on the floor of the recess, when the breech is in place for firing. 2d, The method of operating the clamps to lock and unlock the breech by means of the crossed or shears levers, the double slotted lever, and the plate or broad arm on the transverse shaft. 3d, Moving the breech back and forth by means of arms attached to the same shaft, which is the first mover of the mechanism which actuates the clamps to lock and unlock the breech, the said arms entering recesses in the sides of the breech. 4th, The attachment of the hammer, main spring, tumbler, and feather spring, or all that combination of parts constituting the lock of the gun to the movable breech, or to the same carriage therewith in any way, whereby the movement of the breech is made to effect the cocking and setting free of the hammer to explode the charge. 5th, So constructing the inclined way on the gun carriage which actuates the arm of the lock in cocking the hammer, that if the hammer escapes it will be prevented by the arm coming in contact with the said way from striking the needle, or its equivalent, which explodes the charge, until the breech pin has entered the chamber of the gun."

66. For an *Improvement in Rosin Oil Lamps;* Isaac Pitman, Reading, Mass.

Claim.—"I claim the regulation of the outer current of air of the burner, by means of a sliding ring, or by substantially like means, the same in combination with the vertically stationary and constantly and unvaryingly exposed wick setting snugly between two tubes of unequal height."

67. For an *Improved Water Metre;* Marvin Smith, New Haven, Connecticut.

Claim.—"I claim, 1st, Constructing the piston with cells, arranged in any way substantially as described, to communicate with the inlet and outlet pipes of the cylinder,

so that by a slight movement of the piston on its axis, the communications of the upper and lower parts of the cylinder with the inlet and outlet pipes may be reversed. 2d, The combination of the tongue on the piston rod, the vertical fixed guide, and the connected weighted levers, for the purpose of moving the piston on its axis at the end of every stroke, and thereby reversing the communications of the inlet and outlet."

68. For an *Improvement in Counting Machines, and Machines for Indicating Motion;* Wm. G. Sterling, Bridgeport, Connecticut.

Claim.—"I claim the combination of the revolving endless screw marked with figures on its surface with the stationary toothed nut with a female screw in its centre, fitting the screw on the revolving ring, for the purpose of causing the revolution of said ring."

69. For an *Improvement in Pumps;* John Tapley, Frankfort, Maine.

Claim.—"I claim the arrangement of two cylinders in a line with each other, connected by a frame and fitted with valves, stuffing boxes, and a tubular plunger, which works in both, and has a valve arranged in its middle, the plunger and each of the cylinders being made in two pieces, at the junction of which a valve is secured, so that, without separating the cylinders and plunger, or dismounting either of them, any one of the valves or the packing of the plungers can, with facility, be adjusted, removed, or replaced."

70. For an *Improved Safety Washer for Securing Wheels to Axles;* Wm. Thornley, Philadelphia, Pennsylvania.

Claim.—"I claim a washer having a projecting flanch, and stop or stops; also, the cap with the stop or stops."

71. For an *Improvement in Sausage Stuffers;* John J. Weeks, Buckram, N. York.

Claim.—"I claim the arrangement of the adjustable shaping and protecting tube, in combination with the filling tube."

72. For an *Improved Machine for Sawing Fire Wood, &c.;* Archibald Winter, Rondout, New York.

Claim.—"I claim the employment or use of the endless chains provided with hooks, and arranged with a circular saw, one or more, as shown."

73. For an *Improved Method of Operating Guide Rollers and Feed Clamps in Sawing Machines;* Loren J. Wicks, City of New York.

Claim.—"I claim connecting the two clamps of each pair together by means of the racks and pinions, one clamp of each pair being made adjustable, and connecting the guide rollers together by means of the segment racks and pinions, the rollers, racks, and pinions being secured or attached to a movable or jointed frame."

74. For an *Improved Apparatus for Polishing Daguerreotype Plates;* B. F. Upton, Bath, Maine.

Claim.—"I claim the combination and arrangement of mechanism for supporting the polishing board, maintaining it constantly in one plane, and imparting to it a reciprocating motion, the said combination consisting of the two rocker sectors, the two sets of forward and back draft belts, the connecting rod, and crank, applied as specified."

75. For an *Improvement in Grain and Grass Harvesters;* Abner Whiteley, Springfield, Ohio.

Claim.—"I claim the rack, having on one of its blades a swinging or suspended rake, whose ends pass between and are combined with ways or guides, for the purpose of not only delivering the grain at the rear of the platform, but also, better directing the standing crop to the cutter. I claim the latch with appendages, for the purpose of making the rake gather more or less grain. Also, placing the vibrating knife bar and cutters thereon, between alternately placed fingers, for the purpose of dispensing with the slot guards and sustaining the line of cut, by throwing the action of the alternated shear edge of the blade of said cutters on the upper and lower sides of the fingers."

76. For an *Improvement in Calendar Clocks;* Wm. H. Akins and Joseph C. Burritt, Assignors to W. H. Akins, Ithaca, New York.

Claim.—"We claim, 1st, The arrangement of the four rows of teeth on wheel L, in combination with the corrugated plate, the detent, and the cam, the rocking shaft, and the slotted arm, or the equivalent of said arms and rocking shaft, and for the purposes

set forth. 2d, Raising the clicks 37, over 4 or more of the teeth of the wheel (when run down,) on the first day of the month, thereby acquiring a retaining power sufficient to be used in the short months; thus, moving the wheel carrying the hand on the dial from the 28th day of February, past the 29th, 30th, and 31st divisions of the wheel, to the figure 1, or the first day of March, those teeth (the 29th, 30th, and 31st,) being removed, the detent stopping the wheel at the point marked 1, on figure 8, indicating the first day of every month, one tooth only being used, except at the last day of a short month, the rod, 30, slipping through the end of the lever. 3d, We also claim the combination of the helix, the lever, lifting rod, the detent, the pin, the click, the wheel, and spring, for the purposes described, that is, giving movement to the wheel, the rollers being moved by similar devices."

77. For an *Improved Gold Separator;* Edward L. Seymour, Assignor to Daniel B. Brown, City of New York.

Claim.—"I claim making the said receptacle or vessels of two, three, or more sections, arranged one above another perpendicularly, so that they may be slid off in succession, in a horizontal direction, or otherwise removed, to remove the refuse matter separated from the metal in the first or top section, and the several other layers of stratified matter contained in the other sections, according to their respective specific gravities."

78. For an *Improvement in Calendar Clocks;* John Williams, Assignor to F. Curtis & Co., Hartford, Connecticut.

Claim.—"I claim the wheel *l*, carried by the wheel *e*, and combined with the lever and its stop, and the pin upon the wheel *b*, to engage the lever, the said wheel *l*, having on its periphery forty-eight cogs or teeth, each cog or tooth representing a month, and having upon its upper face three pins and a fourth pin; the three pins making the month of February for three successive years, and the fourth pin the leap year; also, the pins to mark the months of thirty days."

SEPTEMBER 26.

79. For an *Improvement in Gas Generators;* N. Aubin, Albany, New York.

Claim.—"I claim the combination of the gas generating retort with the diaphragm steam generating retort, charged with porous earth, pieces of brick, pumice stone, or some other porous substance."

80. For an *Improvement in Fire Arms;* Fordyce Beals, New Haven, Connecticut.

Claim.—"I claim the rotating of chambered breech or cylinder, by means of a double ratchet, producing rotations by both forward and backward movement of trigger lever acting on side surface of large diameter of cylinder, using for the purpose pawls and ratchets."

81. For an *Improvement in Elastic Goods;* Edward Brown, Rindge, N. Hampshire.

Claim.—"I claim the within described elastic fabric, the india rubber being confined between two thicknesses of stocking work, in the manner and for the purpose set forth."

82. For an *Improved Neck Yoke;* Schuyler Briggs and J. G. Talbot, Sloansville, N. Y.

Claim.—"We claim making two or more sections of a screw on each of the rods which carry the end rings in combination with the nuts in the bar of the yoke, so that it may be used with one end short and the other long, or both ends either long or short, as may be necessary or desirable."

83. For an *Improved Hot Air Furnace;* Gardner Chilson, Boston, Mass.

Claim.—"I claim the arrangement and employment, with respect to a fire pot or chamber, of one or more cones or tapering tubes, without descending bends or flexures, and having their eduction opening or openings made to carry off the non-combustible volatile products, and to retain nearly if not all the volatile combustible products, while the external surface or surfaces of such tube or tubes are exposed to freely radiate heat, the same serving to generate a large amount of heat, and securing a great economy in the consumption of fuel. And, in combination with one or more such tapering tubes made to communicate with the fire chamber, I claim a conical or tapering radiator, closed at top, and arranged directly over the fire, and made to open near its base in the said tapering tube or tubes, and to operate with respect to them and the fire pot or chamber, and the surrounding air or medium to be warmed or heated. I also claim the combining with the upper part of the fire pot, or the rim over the fire pot, and with the

exterior cones or radiators, the conical or partially conical bases or semi-cones attached to and making part of the rim, the same serving not only to facilitate the entrance of smoke and heat into the conical radiators, but the absorption of heat and its radiation towards the floor, and the reflection of heat into the tapering radiators. Also, arranging the feed or fire place door within the trunk or mouth piece, to the fire pot or place, and so as to operate as specified; and, in combination with the mouth piece and the door, arranged in it as specified, I claim the passage in the mouth piece and its plate, for the thin sheet or stratum of air to pass under the door, (while it is wholly closed,) and said plate, and can be heated by contact with the plate before it (the said air,) reaches the fuel. And, in combination with the inclined door of the fire place, the plate, and the air passage directly under it, I claim the ledge or flanch, arranged as described, the same being not only for the purpose of regulating the admission of air into the passage, but of keeping it from passing under the door and over the plate while the ledge is below the level of the top surface of the plate. I also claim the arrangement of the register hole, (viz: in line of or axially with respect to the shaft of the grate,) in combination with the arrangement of the outer end of said shaft, viz: entirely within the throat of the ash pit, or in rear of the registry plate or opening, the said arrangement not only enabling me to dispose of the grate shaft entirely within the ash pit mouth, but to make the registry opening answer the purpose not only of admitting air to the fire when required, but of enabling a person to place a key or crank upon the shaft, for the purpose of turning or moving the grate when necessary, and this without danger of ashes escaping out of the ash pit, provided its door be closed."

84. For an *Improvement in Clasps for Loom Harness;* G. Copeland, Danville, Me.

Claim.—"I claim the clasp, formed of two plates having holes to receive the strap and catches or teeth, or other analogous projections, to catch the harness shaft or rail."

85. For an *Improvement in Knitting Machines;* J. A. Corwin, Newark, N. Jersey.

Claim.—"I claim, 1st, The tool on which the loops are formed and interwoven, consisting of two pieces terminating in hooks or barbs, or other equivalent thereto, and so combined that when motion is given to said pieces, one of the hooks shall seize the loop last deposited, and retain it, while the other shall take up and cast off the loop of the previous course, whereby the two become intertwining, and a netted fabric formed. 2d, The flanch, or any equivalent for making a recess or groove upon the sides of the plate or shank of the horn, whereby a space is made for the point of the take-up hook to pass behind and seize the loop, as described."

86. For an *Improved Parrel and Bow;* John Dane, Portsmouth, New Hampshire.

Claim.—"I claim the construction, arrangement, and combination of the said upper and lower semi-bands with the side pieces or supporters, together with the parrel bow, to which the yarn is secured."

87. For an *Improvement in Bedstead Fastenings;* J. Drayton, Buffalo, New York.

Claim.—"I claim the manner of fastening the end rails to the posts by means of the curved or crooked tenons, in combination with the clamp and wedge for securing the side rails to the posts, as described."

88. For an *Improvement in Electric Clocks;* Alexander Hall, Lloydsville, Ohio.

Claim.—"I claim, 1st, Giving motion to the clock movement, and to the pendulum, by means of a beam and spring, said beam carrying and deriving its motion from the armatures of two electro-magnets, through which electric circuits are alternately closed and broken, and transmitting motion to the clock movement by means of clicks and ratchets, or their equivalents, and to the pendulum, by means of the spring which serves to maintain its isochronous vibration without regard to the strength of the current, and thereby make the clock keep perfect time, and serve to regulate a number of the electric clocks. 2d, The manner of closing and breaking the circuit of the battery, so as to make it pass through one and the other of the electro-magnets alternately, by means of wedge-shaped points, of silver or other metal, which are caused to vibrate by the movements of the pendulum, and pass between small posts of suitable metal attached to permanent magnets, or other conductors, which form parts of the separate circuits through the two electro-magnets. 3d, Securing the connexions which close the separate circuits when they are made by means of two pieces of soft iron, which vibrate in connexion with the wedge-shaped pieces, or other equivalent means of closing the circuit, and are brought, when the circuit is closed, into contact or nearly into contact with permanent magnets."

89. For an *Improvement in Railroad Car Seats;* William Graham and Lawrence McLaren, Philadelphia, Pennsylvania.

"The nature of our invention consists in the double movement of the car seat, and so arranged as to face either end of the car that may be required, by simply shifting the back."

Claim.—"What we claim is, the levers, in combination with the leg rests and the movable seat."

90. For an *Improvement in Chair Frames;* Moses E. Halsey, City of New York.

Claim.—"I claim the construction of the back of a chair, by combining with each post and with the back rail of the seat, a supplementary post sustained and braced."

91. For an *Improvement in Machines for Adding Numbers;* Aaron L. Hatfield, Lewisburgh, Pennsylvania.

Claim.—"I claim the slotted reckoning lever with the spring ratchet attached; the disk D, with its sunken teeth, the curved disk C, with slots cut in the curve; the outer disk and lining with springs; the disk E, with its sunken teeth, cam, and steady pins."

92. For an *Improvement in Whiffle Trees;* Thomas Hardman and Albert Vose, Pittsfield, Vermont.

Claim.—"We claim the use of the iron fastening in the gain or slot, by means of a slide or catch."

93. For an *Improved Machine for Paging Books;* H. Hochstrasser, Philadelphia, Pa.

Claim.—"I claim, 1st, The adjustable escapement; and, 2d, The roller, in connexion with the spaces."

94. For an *Improvement in Platform Scales;* J. F. Keeler, Cleveland, Ohio.

Claim.—"I claim, 1st, The raising or lowering of the platform scales simultaneously at all points without regard to the position of the weight upon the platform, the weighing levers being retained in their proper places for weighing, and preserved from swaying about while the raising and lowering is being done by the intermediate platform or frame. 2d, The combination of the spring balance with the platform scales, arranged in the manner described."

95. For an *Improved Safety Lamp;* Chas. R. Landmann, City of New York.

Claim.—"I claim the use of the pendulum or swinging shaft, in combination with the balance rod, (having a re-action spring in connexion therewith,) and camphene or other explosive fluid lamp."

96. For an *Improvement in Machinery for Felting Hats or Hat Bodies;* J. B. Laville, Paris, France; patented in France, Aug. 29th, 1852.

Claim.—"I claim arranging the two series of rollers mounted in separate frames held or pressed together; but this only I claim when the two series of rollers have a continuous rotary motion, and a longitudinal reciprocating motion, the two series moving in opposite directions. Also, in combination with the two series of rollers for felting hats, the mode of supplying hot water to the two surfaces of the hats as they are passed through the machine, as described."

97. For an *Improvement in Connecting a Series of Car Brakes;* Paul Moody, Camden, New Jersey.

Claim.—"I claim the arrangement of bent levers at each end of every car, having their longitudinal arms projecting beyond the ends of each car, in such manner that when the cars are coupled together, the faces of each opposing arm shall come into contact, and without any fastenings, form a continuous mechanism for operating the brakes throughout a train."

98. For an *Improvement in Running Gear of Locomotive Engines;* Septimus Norris, Philadelphia, Pennsylvania.

Claim.—"I claim in a locomotive engine not having more than one pair of flanched driving wheels, the combination with the driving wheels of one or more pairs of flanched guide wheels, to keep or aid in keeping the engine upon the rails, when the driving and guide wheels are so arranged that while running upon a straight rail the former shall carry the load, and the latter act as guides."

99. For an *Improvement in the Spring to the Knives of Straw Cutters;* J. B. Stockton, Warren County, Kentucky.

Claim.—"I claim the construction and arrangement of the adjustable double spring guide, the moving and the fixed cutters, whereby the moving knife is held up to its work, whether the resistance opposed to it be at the middle, or at either end."

100. For an *Improvement in Harvesters of Grain and Grass;* J. J. Weeks, Oyster Bay, New York.

Claim.—"I claim, 1st, The track clearer, constructed in the form of a spiral or screw, and arranged and operating as described. I claim having each tooth of the sickle work through two of the fingers, in combination with the beveling of the cutting edges of every alternate tooth, so that while one tooth shall have its cutting edges on its upper face, that next to it shall have its cutting edges on its lower face."

101. For an *Improvement in Washing Machines;* M. D. Wells, Morgantown, Va.

Claim.—"I claim the construction of the rubber with a flanch at bottom."

102. For an *Improvement in Washing Machines;* Joel Wisner, Aurora, New York.

Claim.—"I claim the compound spindle, composed of the socket and spindle, for diminishing the amplitude of the vertical movement required in lifting in and removing the rubber, and preventing the binding incident to the said operations when a single spindle is used."

103. For a *Machine for Cutting Irregular Forms;* Arad Aldrich, Princeton, Assignor to John L. Cooper, Worcester, and Arad Aldrich, Princeton, Massachusetts.

Claim.—"I claim, 1st, The making an expansible cutter consisting of two or more parts revolving in the same place, yet capable of separation in the line of their axis. 2d, The combination of the cutters and governing apparatus, when said governing apparatus consists or is formed by slides or surfaces corresponding to the outline of the form required, taken from two or more sections at right angles with each other, as described."

104. For an *Improvement in Uniting Bats for Making Seamless Felt Garments;* D. W. Gitchell, Rahway, N. J., Assignor to John C. Wagstaff, City of New York.

Claim.—"I claim the use of glue, or other equivalent connecting substances, as a means of holding together the surfaces until they can be thoroughly united by the felting process, as described.

105. For an *Improvement in Processes for Making Illuminating Gas from Wood;* W. P. M'Connell, Washington, D. C.

Claim.—"I claim the improvement herein described, in making gas from wood, viz: subjecting the products of destructive distillation therefrom, to a high degree of heat."

Re-Issues for September, 1854.

1. For *Improvements in Pumps for Elevating Water Mixed with Mineral Substances;* William Ball, Chicopee, Massachusetts; dated September 12, 1854; original patent dated December 23, 1851.

Claim.—"I claim the improvement by which the waste, auriferous, or earthy water that leaks out of the shaft hole of the case A, is saved and returned into the body of the case, and the wear of the shaft hole of the chamber prevented; the said improvement consisting in the chamber, the collar, and the passage, as combined together, connected with the case, and the shaft of the fan wheel. 2d, I claim the rings, as constructed and applied to the interior of the pump, for the purpose set forth."

2. For a *Method of Applying Water to Compound Buckets of Flutter Wheels;* David Rankin, Augusta County, Georgia; dated September 26, 1854; original patent dated July 11, 1854.

Claim.—"I claim the so arranging of cuneiform buckets upon the radial arms of flutter wheels, as that in passing through an eccentrically formed water way, three buckets shall receive the volume of water in about the proportions described."

Design for September, 1854.

1. For a *Mole Trap;* Henry Fry, Assignor to Samuel Maxwell, Cincinnati, Ohio; dated September 12, 1854.

Claim.—"I claim the ornamental design."

OCTOBER 3.

1. For an *Improvement in Paddle Wheels;* Abner Chapman, Fairfax, Vermont.

Claim.—"I claim a parallel wheel, composed of a double series of segments, curved in opposite directions, and so arranged as to form continuous waved lines, when this is combined with the unbroken open space between said series."

2. For an *Improvement in the Form of Gas Retorts;* Charles M. Cresson, M. D., Philadelphia, Pennsylvania.

Claim.—"I claim the construction and use of a gas retort with a cellular shell or exterior wall, instead of the usual solid shell or wall; the cells being made to communicate with each other, and with the interior, so as to form either one consecutive series, or several collateral series of communicating cells."

3. For an *Improvement in Steam Gauge;* Victor Beaumont, City of New York.

Claim.—"I claim the peculiar variety of the shape of the so-called flattened spheres, consisting in conical surfaces combined together, so that when the pressure is extending the one, it is compressing the other."

4. For a *Machine for Manufacturing Frames of Wood Saws;* Thomas Batchelder, Candia, New Hampshire.

Claim.—"I claim the combination of the series of rotary chamfering cutters, the bridge or bottom rest, the side rest, the back and fore stops, for the purpose of enabling a person to perform the operation of chamfering each edge of a bar, and forming the chamfer with two tapering ends of a determinate length."

5. For an *Improvement in Brick Machines;* P. S. Devlan, Reading, Pennsylvania.

Claim.—"I claim the manner of actuating a number of plungers by the cranks attached to the eccentric pin upon the stationary journal or axis, by which I am enabled to adapt the well known toggle joint pressure in a simple yet effective manner, to a number of moulds in a revolving brick press."

6. For an *Improvement in Circular Stone Saws;* R. Deering, Sen., Louisville, Ky.

Claim.—"I claim constructing a circular stone saw of sectors of a circle, cut out of rolled or sheet metal in such manner, and in order that the fibre of the metal may be made to run radially through the centre or thereabouts, of each sector, and thus present an end fibre cutting edge all around its periphery."

7. For *Improvements in Warming Houses by Steam;* S. J. Gold, New Haven, Conn.

"The object of this apparatus is, the heating of buildings by radiation from broad, thin chambers, made the receivers and condensers of steam generated in a suitable boiler connected with the heaters, and otherwise arranged."

Claim.—"I claim, 1st, The combination of generater, radiator, and condenser, for the purpose of heating buildings, when the connexion between the generator and condenser is perforated so as to admit of the formation of a hydrostatic column, balancing the pressure of steam on the valve, and permitting the water from the condensation of the steam to return to the regenerator. 2d, The mode of regulating the quantity of steam admitted to the radiator by means of the valve and tubes. 3d, The method of producing a steam-tight connexion between the plates of the condensing and radiating chambers, by means of a card packed between the edges of the plates. 4th, The securing of the thin metallic sheets forming the chambers, by depressing and riveting, for giving the requisite strength to withstand the outward pressure of the steam in a simple and economical manner."

8. For an *Improvement in Drying Cloth;* R. L. Hawes, Worcester, Massachusetts.

Claim.—"I claim the combination of the steam cylinder with the hoops of tenter hooks, when said hoops, after being adjusted to any desired width of cloth on the cylinder, shall move with and have no motion independent of said cylinder."

9. For an *Improvement in Fastenings for Garments;* T. J. Harris, Jr., City of N. Y.

Claim.—"I claim the new manufacture of a button, having an eye capable of being conveniently opened and closed."

10. For an *Improved Dumping Car;* John Kimbel, Zanesville, Ohio.

Claim.—"I claim supporting a single body by bearers depending from the same, and resting on opposite faces of double inclined planes, so that the load may be discharged on either side at pleasure, and the bed returned to a horizontal position, without the aid of windlasses, chains, or other mechanical devices."

11. For an *Improvement in Knitting Machines;* James Y. Leslie, Cincinnati, Ohio.

Claim.—"I claim the combination of the lifting pins with the teeth, provided with grooves for receiving the lifting pins, that the range of loops may be pushed over the pins, and with hooks to hold the crimped thread whilst the range of loops are lifted up and discharged over the said hooks. I also claim the bar termed the presser, in combination with the range of teeth and lifting pins, for the purpose of forcing the range of loops over the said lifting pins, after they have been let down into the grooves of the teeth. And I also claim, in combination with the hooked teeth and lifting pins, the discharging bar, for discharging the range of loops from the lifting pins, after they have been lifted up over the hooks on the teeth. And also, in combination with the hooked teeth, the employment of the thread layers, having a motion downwards and forwards, for the purpose of crimping the thread between the teeth, and forcing it under the hooks by one and the same motion. Also, the employment of movable and adjustable stops, in combination with the thread carrier or carriers, for the purpose of determining the width of fabric to be knitted, and narrowing and widening the same."

12. For an *Improvement in Pen and Pencil Case;* J. J. Lounds, City of N. York.

Claim.—"I claim the slotted tubes, pencil tube, and pen holder; two tubes having enlarged or expanded ends, and the tube and pencil holder having contracted ends, for the purpose of causing the tubes, pen holder, and pencil slide to work snugly and without unnecessary play or looseness."

13. For an *Improvement in Brick Machines;* Francis H. Smith, Baltimore, Maryland.

Claim.—"I claim the flat, square, or triangular bar for pulverizing the clay. Also, in contradistinction from a metallic step, a step composed of wood and iron combined. Also, the open portable mould frame with a projecting flanch, said mould resting on a single detached plate for a bottom, and so that when the mould is thrown on the floor, the brick does not at the same time come in contact with the ground, because the flanches interfere, the concussion being just sufficient to give it a start, when it slips easily afterwards from the moulds."

14. For *Improvements in Machines for Dressing Stone;* William H. Robertson, Hartford, Connecticut.

Claim.—"I claim, in combination with a series of cutters or chisels, applied respectively to levers operated by a set of cams, the turning stop or adjustment bar applied to the chisel carriage. I further claim, in combination with the movable frame, the chisels and the mechanism for imparting to them their up and down movements, a sliding carriage and mechanism for imparting thereto short and reciprocating endwise or lateral movements, in order that the chisels may be made to cut the stone without producing ridges between the parts. I further claim the combination of the series of catch springs or bars with the chisel levers and their carriage."

15. For an *Improvement in Self-Acting Mules;* Wanton Rouse, Taunton, Mass.

Claim.—"I claim communicating rotary motion to the spindles, and governing the said motion in backing off and winding on the yarn during the progressive stages of the building of the cops, through the agency of a double inclined table, having either a rectilinear motion or a circular motion, with every portion of its face moving in a plane, the said table transmitting motion to the shaft which drives the spindle through any mechanical means whereby the desired result can be produced."

16. For an *Improvement in Making Hat Bodies;* Andrew Rankin, Newark, N. J.

Claim.—"I claim, 1st, The combination of the bowing apparatus with the picking cylinders. I also claim the hurdle, having layers of silk, or other material, between the upper and lower perforated material around the edges. I also claim the employment of the transparent cone for setting up and stopping off hat bodies."

17. For an *Improvement in Curtain Fixtures;* Silas S. Putnam, Boston, Mass.

Claim.—"I claim my improved self-fastening curtain roller bracket, as made with a spur, or its equivalent, projected from below the axis of the curtain roller, in combination with a rest or arm extending above the same, and so that said spur and arm may be applied to the opposite of a sash groove, and be made to hold the curtain roller in place."

18. For an *Improvement in the Manufacture of Daguerreotype Cases;* Samuel Peck, New Haven, Connecticut.

Claim.—"I claim the improvement in the manufacture of picture cases or articles, from a composition of shellac and fibrous material, the same consisting in making said case or article of the said composition, and one or more sheets of paper, and pressing and combining the whole together in a press or between dies, so that the paper shall combine or connect itself directly with the composition without the aid of any cement interposed between them, and serve to add great strength to the article so made. And I claim the improvement of ornamenting the surfaces of the impression of the die with burnished gold, the same consisting in applying the gold to the surface of the sheet of paper, or its equivalent, burnishing it while on said surface, and laying the said burnished surface in contact with the surface of the die, and pressing said paper and the plastic composition together and into the die, so as to force the burnished gilding, paper, and composition upon it, and produce the result, as specified. I also claim the extension of the paper up the inner surfaces of the sides of the case, and by means of the pressure in the mould, the same being for the purpose of enabling me to affix to the side the velvet covered frame for the support of the picture, the mat, and the glass thereof."

19. For an *Improvement in Apparatus for Starting Railroad Cars;* William Palmer, City of New York.

Claim.—"I claim the apparatus for starting railroad cars, consisting of the ratchet wheels attached to the car wheels, acted upon by the spring pawls situated within the slotted bars, which are connected by suitable frame work with the draw bar, the whole being so arranged that on starting, the traction of the said draft bar shall be directly upon the top part of the wheels until the pawls are thrown out of gear, and on stopping the car, the draft bar shall be pushed back, hereby setting the pawls for starting again."

20. For an *Improvement in Brick Machines;* Z. M. Paul, Alexandria, Louisiana.

Claim.—"I claim the construction and arrangement of the two mould cylinders, which work in close connexion, one with the other, to wit: forming the intervening blocks between the moulds of quicker convexity than is due to the circle which would circumscribe them, and so arranging the said blocks and moulds of the two cylinders, that they alternately mesh one into the other, whereby the outer face of the brick will be left straight, and the brick be hard pressed in the moulds of either cylinder, alternately in continuous succession. I also claim ejecting the brick from the mould, by percussion or sudden jerk applied to the platen by means of the releasing frame."

21. For an *Improvement in the Feeding Hoppers of Threshers and Separators of Grain;* Spencer Moore, Central Bridge, New York.

Claim.—"I claim the employment of the flap or swing blind, guard board, and shoulder."

22. For an *Improved Pen and Pencil Case;* John Mabie, English Neighborhood, N. J.

Claim.—"I claim having the pencil slide fitted within a tube which is secured permanently within the case, the tube B having a spiral slot cut through it at its upper end, encompassed by a tube F, also having a spiral slot cut in it in a reverse direction to the slot in the tube B, the pencil slide being provided with a pin which passes through the two slots, and which is operated upon by turning the tube F, so that the pencil slide is forced into or out from the case."

23. For an *Improvement in Railroad Draw Bridge and Switch Telegraph;* Wm. C. McRea, Philadelphia, Pennsylvania.

Claim.—"I claim the giving of a signal on a car or locomotive, by the arrangement of an electro-magnet upon said car or locomotive, in such a manner as to constitute part of a galvanic circuit when the wheels of the car or locomotive touch an insulated portion of the track while the train is in motion, thereby causing the electro-magnet to be

acted upon by a distant battery for giving said signal. I also claim attaching the wires of a galvanic circuit at railroad draw bridges or switches, in such a manner that the opening of the draw or changing of the switch may separate a part of the wire of said circuit, and closing the draw or replacing the switch, shall again complete the connexion of that part of the wire which was so separated, when used in connexion with the before specified arrangement for signalizing on the car or locomotive when in motion, the completion of the circuit."

24. For an *Improvement in Mosquito Curtains;* Benjamin B. Webster, Boston, Mass.

Claim.—"I claim so combining a musquito curtain with a window, that it may be attached to the sash of the window, and a roller applied to the window frame, and be operated by said sash, and so as to close the opening produced by the raising of said sash, the said curtain being wound upon the roller by the action of a spring, or its equivalent, when the sash is in the act of being closed."

25. For an *Improved Printing Press;* Ervin B. Tripp, Concord, New Hampshire.

Claim.—"I claim giving the necessary feed motion to the press by means of the reciprocating tympan and frisket, nipper bar, cylinder, and guides. 2d, I claim the employment or use of the endless belt with oblique rollers placed thereon, and arranged with the ink fountain and rollers, for the purpose of equally distributing the ink upon the rollers."

26. For an *Improvement in Processes for Purifying Fatty Bodies;* Richard A. Tilghman, Philadelphia, Pennsylvania; patented in England, Jan. 9th, 1854.

Claim.—"My invention consists of a process of producing free fat acids and solution of glycerine from those fatty or oily bodies of animal and vegetable origin, which contain glycerine as their base. I claim the manufacturing of fat acids and glycerine from fatty bodies, by the action of water at a high temperature and pressure."

27. For an *Improvement in Movements of Gas Metres;* J. Thatcher, Philadelphia, Pa.

Claim.—"I claim operating the index of gas metres by means of the lever adapted to move or slide against a controlling pin or fulcrum, or its equivalent, the measuring wheel and index movements being connected with the lever by means of the crank, or their equivalents."

28. For an *Improvement in Looms;* Joseph Welsh, Philadelphia, Pennsylvania.

Claim.—"I claim the application to the lay of those looms requiring or having a moving shuttle box, a periodically moving shuttle stopper, which receives its motion from any suitable part of the loom, and independently of the picker and shuttle box, or either of them, and continues so to act as to arrest or stop the motion of the shuttle, without injury to the same or to the box, on its arrival within the said box, and then immediately turns or moves from the same, so as to allow a perfectly free and independent motion of the box, and also of the picker, during the working operation of the loom."

29. For an *Improvement in Sewing Needles;* John Wilcox and Stephen H. Whitridge, Philadelphia, Pennsylvania.

Claim.—"We claim a sewing needle, the stem or body of which is made of gold, and the point of iridium, the two metals being reduced and united."

30. For an *Improvement in Hot Air Furnaces;* John E. Grant, Charlestown, Assignor to Cyrus Carpenter and Augustus D. Shaw, Boston, Massachusetts.

Claim.—"I claim the deflecting plate with its saddle flanch, when interposed in the combustion chamber between the products of combustion and exit pipe."

31. For an *Improvement in Piano Forte Stools;* Levi Van Hoesen, Assignor to the 'New Haven Iron Railing Company,' New Haven, Connecticut.

Claim.—"I claim the combination of the part (with its serrated or notched edges,) with the double acting dog, when the dog is operated by the bar."

MECHANICS, PHYSICS, AND CHEMSTRY.

For the Journal of the Franklin Institute.

On an Improved Mode of Producing Draft in Marine Boilers Burning Anthracite Coal. By J. VAUGHAN MERRICK.

(Patented May 6th, 1854.)

The use of anthracite coal in marine boilers depending on natural draft for combustion, is attended with the difficulty that in smooth calm weather, or light favorable winds, or at the time when circumstances favor a rapid passage, the draft is deficient, and the supply of air to the fire rooms diminished, causing a reduced production of steam. What is termed "natural draft," is traceable to two causes; 1st, The rarefaction due to the elevated temperature of the gases in the chimney; and, 2d, The influence of winds, &c., in supplying air for combustion, or in their effect on the contents of the chimney. It is this latter element which is so variable, and which has generally caused the introduction of blowers for use in calm weather.

These blowers are generally placed below, in the fire rooms, or between the boilers, and the nozzles conduct the air below the fire room floors into channels leading under each furnace door. These channels are provided with traps, by which they may be shut off when fires are cleaned. Now, the use of blowers with forced blast, is attended with serious inconveniences, among which are, the great power expended in driving them; a rapid destruction of the furnaces, caused by the intense local heat; waste of fuel, expense of construction, &c.; besides which, it is requisite to raise the boilers high enough to get the air channels under the floor, which, with return tubular boilers, is a serious evil. These objections, which may fairly be advanced against blowers, cannot be charged against exhausting fans, which produce an effect similar to that of natural draft.

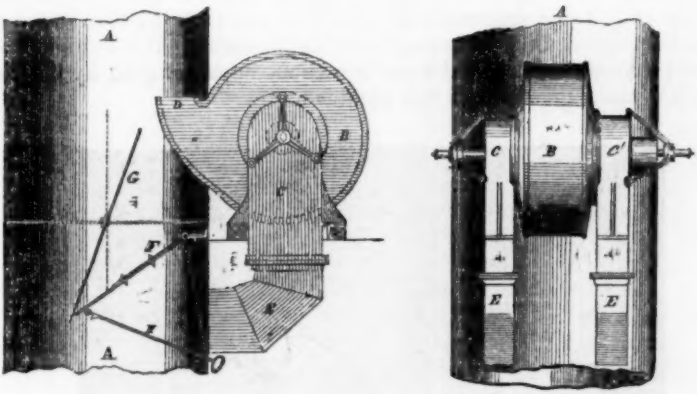
Exhausting fans are not a new device for the purpose of producing draft. Peclet describes and illustrates a plan for using them in stationary boilers. Captain Ericsson also used them, and applied one to the auxiliary screw steamer *Massachusetts*, which is the only case within my knowledge wherein they have been employed in marine boilers.

About ten months ago, it became an object to increase, at times, the evaporative power of the boilers of the steamship *Keystone State*, which, although amply large in ordinary weather to carry high steam, would not supply to the required extent in calm weather. The use of fan blowers for forced blast was considered objectionable for reasons previously given. The use of steam jets was not advisable, as the engine has a fresh water condenser. The only remaining plan was an exhausting fan. But it was necessary to have this fan so arranged that when not in use, the boilers should be in their original condition, and that when in use it could be easily accessible. The plan adopted by Capt. Ericsson in the *Massachusetts*, where the blower case was built in the body of the chimney, does not fulfil either of these conditions; besides which, the chimney of the *Keystone State* was already in place; and, whatever plan was adopted,

had to be applied in a very limited period of time. To fulfil all the desired conditions, I designed the arrangement hereafter described; and, in order to show the effect produced by the fan, have waited till a careful experiment could be made, of which the results are given below.

The fan is 4 feet diameter, 2 feet wide, with passages 2×2 feet, is supported on the hurricane deck, and placed forward of the stack. It is driven at about 500 revolutions per minute by a vertical non-condensing engine, with cylinder 8 inches diameter, and 1 foot stroke, the belt carried round the fly wheel; the engine makes one revolution to five of the fan. The whole space occupied by fan, engine, belting, &c., is 8 feet square, and the whole of the machinery is protected by a house, similar in appearance to the pilot house. It has been in use whenever required, since January last, and was entirely successful in the object for which it was put up. As the number of revolutions of the fan is limited, the evaporative power of the boilers would not be increased in head winds. But its effect in smooth weather is exactly what was intended, viz: to supply the deficiency of draft. Of course, it is not claimed that the economical efficiency of the boilers is increased, but simply their evaporating power.

Description.—The fan of the *Keystone State* is represented in the accompanying illustration:



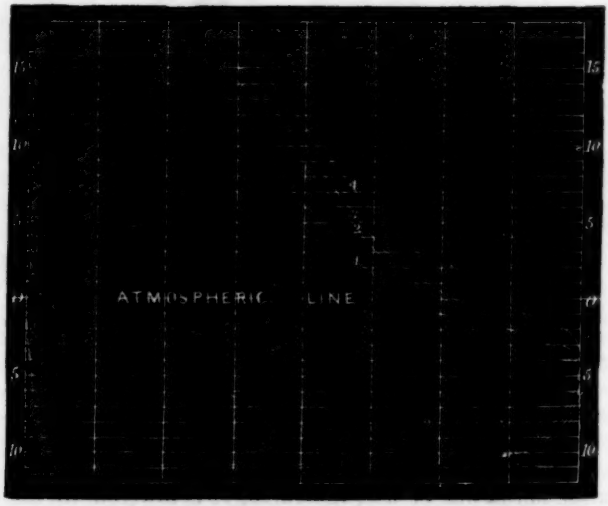
References, A, smoke pipe.
B, fan.
C C, inlet boxes.
D, outlet.
E, inlet pipes.
F, hinged valve or deflector.
G, damper of stack.
H, handle for regulating inlets, &c., of fan.

When the fan is out of use, the valve, F, is lowered to the position shown in dotted line, against the forward side of the stack, covering the inlet openings, E, to the fan, and shutting it off, so that it is not heated

by the passage of the gases, &c., and may be oiled or adjusted; while the damper, G, is placed so as to regulate the draft, as usual.

When the fan is in use, the valve, F, is raised to the position indicated in full lines, the damper, G, placed vertically, or nearly so, its lower side being against the valve. The ascending current is thereby divided into two portions. That on the forward side striking the valve, is deflected into the fan, whence it is ejected upwards at an increased velocity into the stack, thus forming a current which draws with it the other portions of the gases, passing up the after side of the stack, and the whole mass has its velocity increased, or, in other words, the natural draft is intensified.

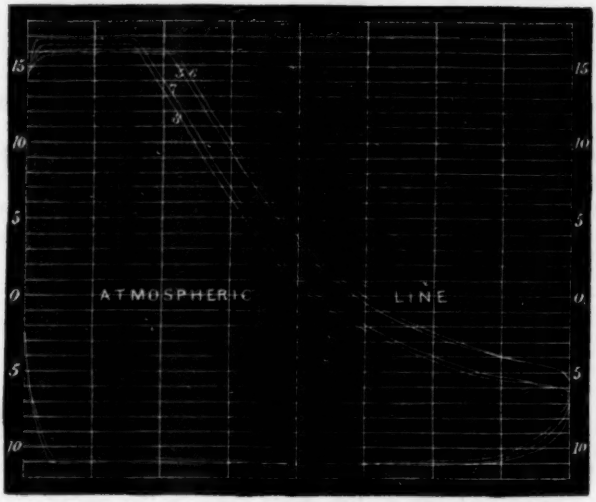
Results Obtained.—To ascertain how much the evaporation was increased by this device on board the *Keystone State*, the engineer chose a day of settled weather, with very light winds on the quarter, and run the fan one watch of four hours, noting the whole number of revolutions made by the engine, and maintaining a uniform (or nearly so,) pressure of steam in the boilers, by adjusting the cut-off; at intervals of 45 minutes, four indicator cards, marked 1, 2, 3, and 4, were taken, an average of which will give the mean performance throughout the whole period. The blower was then thrown off, and the same particulars noted for the next four hours, the four cards marked 5, 6, 7, and 8, being taken at similar intervals. An inspection of these diagrams will show that during the use of the fan, the cut-off had constantly to be lengthened, showing that the fires were improving; while, during the last watch, the cut-off had constantly to be shortened, showing that although the fires were left in good condition, they were constantly deteriorating. It is evident that a more prolonged trial would have shown an apparent gain by the use of the fan, much greater than that obtained.



Indicator diagrams taken on the engine of the *Keystone State*, Oct. 28th,

1854. Cylinder—diameter 80 inches; stroke, 8 feet; dip of wheels, 4 feet 7 inches; temperature of hot-well, 120°.

(For further particulars, vide *Journal*, vol. xxv., 3d Series, p. 139.)



With the Fan.

Cards.	Time.	Steam in boilers in pounds.	Vacuum per gauge in inches.	Av. revs. per minute.	Cut-off in feet.	Initial pressure in cylin.	Mean press. in cylinder.
No. 1.	9·15 A. M.	18·	24	15·60	2·33	16·25	17·36
No. 2.	10 "	17·75	24	15·65	2·55	16·50	18·40
No. 3.	10·45 "	18·50	24	16	2·60	17·25	18·98
No. 4.	11·30 "	18·50	24	16·14	2·80	17·33	19·91
Means,		18·19	24	15·69	2·57	16·83	18·66

Without the Fan.

No. 5.	1·15 P.M.	18	24	15·	2·00	15·75	15·80
No. 6.	2 "	18	24	15·	2·20	16·25	16·10
No. 7.	2·45 "	18	24	14·50	1·65	16·50	15·17
No. 8.	3·30 "	18	24	14	1·60	16·75	14·88
Means,		18	24	14·90	1·86	16·31	15·49

Revolutions during first watch, 3766; revolutions during second watch, 3575.

Comparison.—To compare these results, it is evident that we must compare the amounts of water evaporated, which are in proportion to the number of revolutions, and the portion of stroke performed before steam is cut off, (added to the clearance,) divided by the volume of steam at the initial pressure given in the last column but one of the above tables.

This clearance at each end of the piston amounts to 0·23 feet, by the area of the piston. Hence we have—

$$\text{With the fan} \frac{3766\times(2\cdot57+\cdot23)}{840} = 1255.$$

$$\text{Without the fan } \frac{3575\times(1\cdot86+\cdot23)}{853} = 870.$$

The numbers 840 and 853 being the respective volumes of steam at 16·83 and 16·31 lbs. per square inch.

Then 870 : 1255 : : 100 : 1·44, or, gain for whole period, 44 per ct.

To show the comparison at the time of the last observation in each watch, which would be more nearly a criterion than the mean performance, we have, (taking the average revolutions per minute, instead of the total number,)

$$\text{With the fan } \frac{16\cdot10\times(2\cdot80+\cdot23)}{829} = 0\cdot5880.$$

$$\text{Without the fan } \frac{14\times(1\cdot60+\cdot23)}{841} = 0\cdot3046.$$

Then, 0·3046 : 0·5880 : : 1·000 : 1·927 ; or, the evaporative effect was nearly *doubled*, and the speed of the ship (engine) increased as 14 : 16·10, or about two statute miles per hour. In the above calculations, no account is taken of the steam used by the engine driving the fan, which may be estimated as equal to about one-fourth the main cylinder full of steam per minute, and would amount to about $2\frac{1}{2}$ per cent. in the first, and 2 per cent. in the second case.

It is not claimed that these results would be at all extraordinary if produced by blowers in the usual manner; but when it is considered that they are produced with a very trifling expenditure of power, without waste of fuel, without any destructive influence on the furnaces, that both the fires and the blowing machinery are perfectly accessible for cleaning at all times, and, in short, that all the well known advantages of natural draft are combined with the power of nearly doubling the evaporation in calm weather, I think the results show an improvement sufficiently marked to be worthy a place in this *Journal.*

On the Effect of the Pressure of the Atmosphere on the Mean Level of the Ocean. By Captain Sir James Clark Ross, R.N., F.R.S.

The author states that, in September 1848, Her Majesty's ships *Enterprise* and *Investigator* having anchored in the harbor of Port Leopold, in lat. 74° N. and long. 91° W., a heavy pack of ice was driven down upon and completely closed the harbour's mouth, thus effectually preventing their egress, and compelling them there to pass the winter of 1848-49. It was during that period that the series of observations here presented to the Royal Society was obtained ; and, as the observations were made under peculiarly favorable circumstances, the author consid-

* From the Lond., Edin. and Dub. Philos. Mag., Oct. 1854.

ers they will throw some light on the movements of the tides, and on some of the causes of their apparent irregularities.

Soon after the harbor had been completely frozen over, a very heavy pressure from the main pack forced the newly-formed sheet of ice, which covered the bay, far up towards its head, carrying the ships with it into such shallow water that at low spring-tides their keels sometimes rested on the ground. Under these circumstances the movements of the tides became to the author an object of great anxiety, and consequently of careful observation, in order to ascertain the amount of irregularities to which they were liable in that particular locality.

The first few days' observations evidenced much larger differences in the elevation or depression of successive high or low-waters than could be accounted for by any of the generally received causes of disturbance; and the author was at once led to connect them with changes of the pressure of the atmosphere, from perceiving that on the days of great atmospheric pressure high-water was not so high as it ought to have been, and low-water was lower than its proper height; and that the reverse took place on the days of smaller pressure.

As it was found that the usual method of determining the mean level of the sea, by taking the mean of successive high and low-waters, was inadequate to the detection of small quantities arising from a change in the pressure, a system of observation was adopted different from that heretofore practised, in order to determine the mean level of the sea on each day.

In the first instance, simultaneous observations of the height of the tide and of the mercury in the barometer were made every quarter of an hour throughout the twenty-four hours. From these it was found that the mean level of the sea for each day could be determined with great accuracy, and that the variation in the daily mean level and in the mean pressure of the atmosphere followed each other in a remarkable manner, so that a rise in the former corresponded to a diminution in the latter. Subsequently, however, hourly observations were adopted.

The peculiar advantages of the position of the ships at Port Leopold for making tidal observations are stated to have consisted in:—

1. The great width of the entrance of the harbor admitting the free ingress and egress of the water, combined with the large field of ice which covered the whole of the bay, completely subduing every undulation of the water.

2. The steady movement of the immense platform of ice, rising and falling with such singular regularity and precision as to admit the reading off the marks of the tide-pole with the greatest exactness, even to the tenth of an inch.

3. The shallowness of the water and the evenness and solidity of the clay bottom admitting the fixture of the tide-pole with immoveable firmness.

4. The whole surface of the sea in the neighborhood being, for the greater part of the time, covered by a sheet of ice, preventing those irregularities which occur in other localities from the violence of the wind raising or depressing the sea in as many different degrees as it varied in strength or duration.

For fixing the tide-pole for the "*Enterprise*," a hole 2 feet square was cut through the icy platform, and a strong pole, nearly 40 feet long, was passed through it and driven firmly down several feet into the clay, being fixed by heavy iron weights, which also rested on the clay and prevented any movement of the pole. It was placed in about 21 feet depth of water at the time of mean level of the sea. Another such tide-pole was, in a like manner, fixed through a hole in the ice close to the "*Investigator*," for the sake of reference and comparison.

Hourly observations of the height of the tide and of the barometer were commenced on the 1st of November, and were continued by the officers of each ship throughout the whole of the nine following months to the end of July. After forty-seven days of observation, an interruption in one of the series occurred in consequence of the tide-pole of the "*Enterprise*" having been drawn up by the ice, to the under part of which it had become frozen. The amount of displacement of the pole was easily determined by a comparison with that of the "*Investigator*," but several days elapsed before it could be satisfactorily fixed at the same point in which it had been originally. The observations of these forty-seven days are those which are given in the paper, and their discussion is the immediate object of the communication.

It is stated that subsequent observations seem to show that, from the time of the interruption to the middle of July, there was a progressive elevation of the mean level of the sea, which, although of small amount, was sufficiently evident from month to month to render the subdivision of the series desirable, in order that the individual observations of each separate division should be strictly comparable.

The height of the sea and the corresponding height of the mercury in the barometer, at every hour in each day, from the 1st November to the 18th December, 1848, are given in tables. In these arithmetic mean of the hourly heights of the sea for each day is taken as the mean level of the sea for that day, and the mean of the hourly heights of the barometer is taken as the corresponding height of the barometer. These mean levels and corresponding mean barometric heights are given in another two-column table, arranged in the order of the days of observation; and in a third table these are arranged in the order of the heights of the barometer with the corresponding mean levels, without regard to the dates of observation, for the purpose of showing the dependence which the latter have on the former.

On these tables the author makes the following remarks. The forty-seven days of hourly observations give for the mean height of the barometer 29·874 inches, and of the mark of mean level of the sea 21 feet 0·21 in.

The mean of three days of *greatest* pressure was:	30·227, and of corresponding level	20 feet 8·4 inch.
The mean of three days of *least* pressure was:	29·559, and of corresponding level	21 feet 5·4 inch.
Diff.	+0·668	Diff. —9·0

Thus a difference of pressure equal to 0·668 inch produced a difference of 9 inches in the mean level of the sea. As the ratio of 9 to ·668 is

13·467 to 1, the author considers that the effect of the pressure of the atmosphere on the level of the sea is 13·467 times as great as the effect it produces on the mercury in the barometer, or very nearly in the inverse ratio of the specific gravities of sea-water and mercury. He however states, that this remarkable coincidence must be considered in a great measure accidental, for if a greater number of days' observation be taken in order to deduce the mean greatest and mean least pressure, and the corresponding mean levels, a different result will be obtained. From these observations, however, he considers that he has been enabled to deduce results which plainly point to the law which governs the effect of the pressure of the atmosphere on the mean level of the sea, and may be encouraged to pursue the investigation through a more extended series of observations, in order to arrive at the most accurate conclusion that the observed facts may justify.

In conclusion, a formula is given for determining the correct height of the tide, or of the mean level of the sea:—

Let L denote the correct height of the tide, or of the mean level of the sea;
B the mean pressure of the atmosphere;
λ the observed height of the tide, or of the mean level of the sea;
β the corresponding height of the barometer;
D the ratio of the specific gravity of mercury to that of sea-water:
then $L=\lambda+(\beta-B)\,D$.

Examples are given of the application of this formula.

For the Journal of the Franklin Institute.

Remarks upon the Use of Phonic Signals in Navigation. By Prof. John C. Cresson, C. E.

Among the numerous suggestions, elicited by the melancholy loss of the steamer *Arctic*, for the prevention of such disastrous collisions, there is none that appears so easily attainable as the use of the steam whistle, or, more correctly, steam trumpet.

The proper mode of using this instrument being, therefore, a matter of some importance, a few remarks, based upon experimental knowledge, may be a not inappropriate contribution to the pages of the *Journal*.

It is well known that the blast of a large steam trumpet is distinctly audible at the distance of five miles, and instances are known of its being heard at more than twice that distance in cloudy weather.

It has been found, also, that this peculiarly abrupt sound is well adapted for the formation of distinct echoes, and at sea its echo from a bluff coast or a ship is very remarkable, so as to be quite startling when heard for the first time in darkness or fog. The writer took part in some trials of it on the Bay of Fundy, which proved that this echo would give notice of approach to a rocky headland, distant several miles, and of a small schooner more than a mile off.

May not these qualities of the steam trumpet be so applied as to make it not only give a warning signal to others outside the ship, but also to return the warning to the ship giving it? If so, how is it best to be accomplished?

Experiment has shown that a loud, abrupt sound, produces a complete impression on the sense of hearing, if its duration be only one-eighth of a second of time; and, further, that sound travels through the air at the rate of a sea mile in about five and a half seconds. A vessel running at twelve knots, passes over a sea mile in five minutes, so that two vessels three miles apart, running head on at this rate, would come together in seven and a half minutes. A consideration of these facts leads to the following practical conclusions as to the proper mode of using the steam trumpet in dark or foggy weather.

Instead of blowing it continuously for any length of time, it should be blown in short, abrupt blasts, with a considerable interval of silence, the length of which should be varied with the speed of the vessel, and other circumstances.

As a blast continuing an eighth of a second is audible, we may safely depend upon making a good impression on the ear, even at a distance, by giving it sixteen times that duration, or two full seconds. This could be heard at sea for the distance of five or six miles, and its echo from any large object above the horizon, would be audible when two or three miles off. The intervals of silence ought to be such that two vessels three miles apart could not come together between two consecutive blasts, if running right head on. If their united speed be not more than twenty-four knots, it will be quite safe to allow five minutes, as there would be at least two blasts returned by echo to the vessel making the signal, and many more audible to the watch on the other vessel, before they could come into contact.

The quantity of steam required for such use of the trumpet, would be less than one-hundredth part of that consumed in sounding it continuously; and even if the intervals between the blasts be reduced to two or three minutes, it would use but an insignificant amount of steam, probably not one-tenth of a horse power.

Another advantage accruing is, that this mode of signaling not only gives warning of approaching vessels, but also will make known the proximity of icebergs and headlands, or any other large object above the horizon; it may even, in cloudy weather, give warning of land many miles beyond the horizon, by means of the reverberation from the clouds to the land, and back by the same course.*

The interval of silence also allows the look-out man to hear any signal given by another vessel in reply to his own.

To obtain the best effect from the trumpet, it should be placed forward of the smoke pipe, elevated 20 or 30 feet above deck, and be provided with a bell-shaped reflector that will project the sound strongly forward, and limit its range to 60 or 90 degrees of azimuth.

The signal man should have his place of look-out at the bow of the vessel, where he should have a small pent-house screen or shelter directly

* A curious illustration of the reflexion of such sounds by clouds, has recently been observed upon a railroad in this State, which crosses one of the principal mountains in the anthracite coal field of Schuylkill county; the steam signals given by a locomotive in the Mahanoy Valley, north of Broad Mountain, being distinctly heard, in cloudy weather, at a station ten miles distant, on the south of the mountain. The height of the interposed mountain above the two points was over seven hundred feet.

above and behind him, so as to protect his ears from the intensity of the sound of his own trumpet, and thus preserve his acuteness of hearing for catching the feebler echoes returned by very remote objects. The accompanying rough sketch (Plate IX,) shows the arrangement of these things deemed most effective. A coarsely made time-keeper, with a strong chronometer escapement beating full seconds, should be provided and placed under the small pent-house, in view of the signal man, by the beats of which he may regulate the duration of his blasts, and the intervals of silence; and may also, by counting beats between a signal and its echo, estimate the distance of the echoing object. The right method of proceeding is this: at night, and in fogs, let the look-out man make his signals regularly, according to orders, say every four minutes, keeping up the sound for two seconds or beats of his time-keeper; the regularity with which he performs this, will be a good indication of his vigilance.

Should he at any time hear an echo, he must repeat his signal at a half interval, say two minutes, and immediately count the beats of his time-keeper until the echo is again returned. Should the time be long, say as much as thirty seconds, he will know that the stranger is about three miles off, and he may again give his blast in the half interval of two minutes; should the observed time of this third echo be as great as before, he must continue his signals at half intervals until he observes a change in the time of the return of the echo; should it become shorter, he must give his signal sooner, say at a quarter interval of one minute, and so on. Should the time of the echo become longer, he may lengthen his interval to three minutes, and if the echo ceases, he may return to his regular four minute interval.

The velocity of sound being, approximately, a sea mile in five seconds, and the echo requiring time to go and return, the distance of the echoing object is to be estimated at a mile for every ten seconds, or when greater accuracy is desired, it is to be taken at a mile for eleven seconds.

Now, let us consider for a moment the results of these proceedings. In the first place, the man on look-out has been giving notice to all on board that he is at his post, and awake, which satisfactory announcement will continue without change, so long as nothing above water nears the ship. As soon as there is anything ahead large enough to give an echo, the change of interval between the signal blasts gives immediate notice of the fact to the officer on duty, and all others on watch; the officer can at once make his own observations as to the nearness of the approaching object, and its rate of approach. Experience will soon enable him to judge pretty correctly with regard to its position, its size, and its general character, that is, whether it be a ship or an iceberg, a rock or a coast. The engineer having received the same warning, is prepared to stand by for stopping or reversing, and the helmsman is on the alert for orders to change his course.

A system of Phonic language may easily be devised for giving all the requisite information by approaching vessels of each other's course and intended movements. Railroad engine men have a very simple system of conveying such knowledge with great precision. Should the steam pressure of the engine be too low to produce an energetic blast, a small

furnace and boiler, occupying but half the space of a cook's galley, would furnish abundance of high steam.

On sailing vessels, a hand force pump or bellows for compressing air into a strong receiver, would answer every purpose.

As these abrupt trumpet blasts will be more unlike the ordinary sounds heard on ship-board at sea than a continuous sound would be, they will more effectually arouse attention, and this tendency might be further increased by making the blast suddenly change its tone, as is done in the Indian whoop, in which an abrupt rise in tone, to the extent of an octave or more, gives a peculiarly startling effect.

Philadelphia, Nov. 24th, 1854.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Potomska.

Hull built by Capes & Allison, Hoboken. Machinery by Hogg & Delamater, New York. Intended service, New York and New Bedford.

HULL.—

Length on deck, from fore part of stem to after part of stern post,	140 feet.	
Breadth of beam at midship section,	26 "	
Depth of hold,	8 "	6 inches.
Draft of water at load line,	9 "	
" " below pressure and revolutions,	10 "	
Masts and rig,	three masted schooner.	

ENGINE—Vertical direct.

Diameter of cylinder,		34 inches.
Length of stroke,	2 feet	6 "
Maximum pressure of steam in pounds,	35.	
Maximum revolutions per minute,	54.	
Weight of engines,	20 tons.	

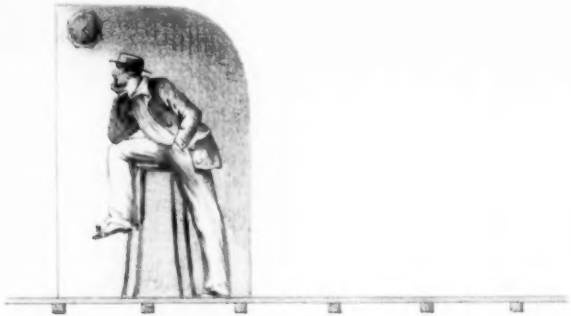
BOILER—One—Vertical—Tubular.

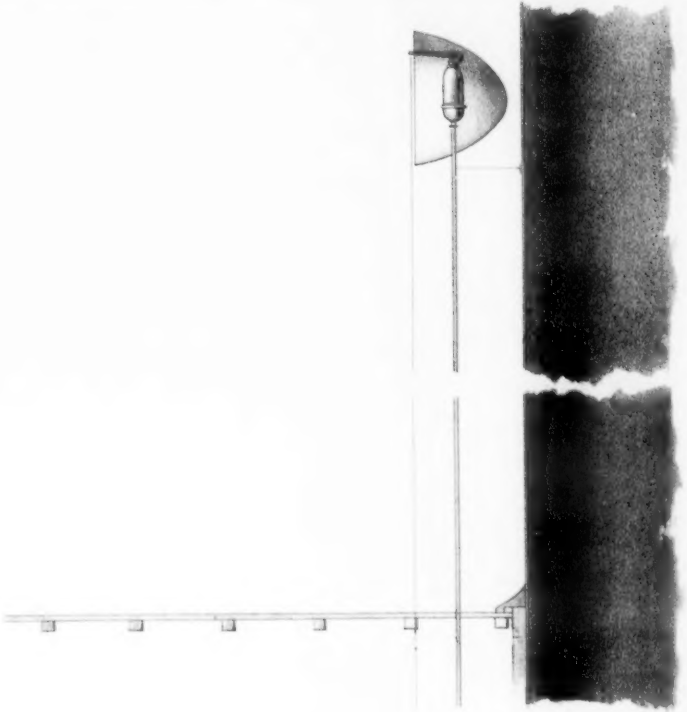
Breadth of boiler,	6 feet 9 inches diam'r.	
Height " 7½ diameter, 19½ feet high. Horizontal tubes, five outside of tubes.		
Weight of boiler without water,	8½ tons.	
Number of furnaces,	one.	
Number of flues or tubes,	587.	
Internal diameter of flues or tubes,		2 inches.
Length of flues or tubes,	4 feet	
Heating surface,	1500 sq. feet.	
Diameter of smoke pipes,	2 "	8 inches.
Height "	20 "	
Description of coal,	anthracite.	
Consumption of coal per hour,	½ ton.	

PROPELLER.—

Diameter of screw,	9 feet.	
Pitch of screw,	21 "	
Number of blades,	4.	

Remarks.—Floors filled in solid under engine. C. H. H.





Translated for the Journal of the Franklin Institute.

A New Flesh Broth for the Sick. By Justus Liebig.

To prepare a portion for one person of this flesh broth, take a half pound of meat of some freshly slaughtered animal (beef or chicken,) chop it finely, and mix it well with eighteen ounces of distilled water, to which has been added four drops of pure hydrochloric acid and from a half to one drachm of culinary salt. After standing for an hour, the whole is thrown upon a conical hair sieve,* such as is to be found in every kitchen, and suffered to drain without the application of any pressure. The first cloudy droppings are returned to the sieve until it flows quite clearly. A half pound of distilled water is then thrown in small portions upon the residue in the sieve. In this way is obtained about a pound of liquid (cold extract of flesh,) of a red color and pleasant broth taste. It is administered to the patient, cold, by cups full at pleasure. It should not be heated, as it then becomes cloudy, and gives rise to a thick deposit of flesh-albumen, and hæmatin.

A young girl of eighteen years of age, having become sick in my house from an attack of typhus, gave occasion for this preparation, through a remark of my family physician, (Dr. Pfeufer,) that in a certain stage of this disease the greatest difficulty which is presented to the physician arises from the defective digestion, a consequence of the condition of the intestines; and besides, from the want of a suitable diet for digestion and the formation of blood. In fact, in the ordinary broth prepared by boiling, there are wanting all those very components of flesh that are necessary to the formation of blood-albumen, and the yolk of egg which is added is very poor in these substances, for it contains in the whole, 82½ per cent. water and fat, and only 17½ per cent. of a substance like egg-albumen, or a very similar substance, and whether this replaces flesh-albumen in its nutritive powers, is, according to Majendie's experiments, at least doubtful. Besides flesh-albumen, the new broth contains a quantity of hæmatin, and therein a far greater quantity of the iron for the formation of the blood corpuscles, and finally the digestive hydrochloric acid.

A great difficulty in the use of this broth is, that sourness arises from its undergoing change in warm weather; it enters regularly into fermentation, like sugar-water with yeast, without giving rise to a bad smell; the body thus formed is very well worthy of investigation. The extraction of the flesh must, therefore, be undertaken with quite cold water, and in a cool place. Ice water and external ice cooling remove this difficulty completely; above all, it is strictly to be cared for, that the flesh is *fresh, and not several days old.*

This broth has come into use in the present City Hospital (Munich) as well as in the private practice of several of the most distinguished of our physicians, as Doctors von Gietl and Pfeufer.

I would, perhaps, have hesitated about giving so simple a thing a greater publicity than it merits, had not a late, and for my family, important event, fully convinced me of the great nutritive power of this soup,

* Or such a strainer as is used in this country for calves-foot jelly. Trans.

and the natural wish arose that its use might be proved in larger circles, and that other sick might experience its beneficial effects.

A young married lady, who, in consequence of inflammation of the ovaries, could partake of no solid food, was kept exclusively upon this diet for two months, and to the perfect restoration of her health; during this time she improved perceptibly, both in flesh and strength.

The patients generally take the soup without any resistance as long as they are sick, but as soon as they can partake of other food, they refuse it, which, perhaps, arises from the color and slight flesh smell. For many, therefore, it might prove of use to color the broth brown by burned sugar. *Annalen de Chemie und Pharmacie.* Aug., 1854. VOL. XCI, p. 244.

On Baker's Furnace.

To the Committee on Publications:

BOSTON, MAY 18th, 1854.

SIR:—In consequence of the articles respecting Baker's Steam Boiler Furnace in your *Journal* for September and October, by Mr. Isherwood, I beg leave respectfully to submit the accompanying certificate, which answers any doubts as to the true value of the furnace; and I beg for it a place in your valuable *Journal.*

Respectfully, yours,

J. AMORY.

The undersigned having, at the request of Mr. Amory, the agent for Baker's patent boiler furnace, visited the blacksmith's shop at the Navy Yard, in Charlestown, for the purpose of observing the effect produced by the peculiar mode of setting steam boilers, in conformity with the said patent, as exhibited in the furnace which is in regular operation at that shop, respectfully submit the following statement:

Our attention was called to the prefatory remarks contained in a report made by Mr. B. F. Isherwood, and published in the *Franklin Journal*, of some comparative experiments on one of the said furnaces, at the Navy Yard in Washington, and on the furnace constructed under the direction of the Engineer-in-Chief at that Yard. In those remarks, Mr. Isherwood contradicts the fact asserted by Mr. Baker in the specification of his invention, that in the form of constructing what he calls "reverberating chambers," in combination with the fire places and boiler, "they are made to revolve and retain the volatile products underneath the boiler long enough to be consumed." This allegation of Mr. Baker's specification is controverted by Mr. Isherwood, by various arguments, in the course of which he uses the following language:

"As far as regards the revolving and retaining of the heated gases by means of the arches, it is quite certain these gases will not be at all *revolved* or retained, but instead of following the shading in Fig. 2, representing their course, according to Mr. Baker, they will follow in a straight line, taking the shortest and most direct route from furnace to chimney, and leaving the arches beneath the dotted line, Fig. 2, filled with quiescent gases. In a word, the reverberating chambers of Mr. Baker do not reverberate, and cannot, as arranged, be made to do so."

We are not called on to reply to the argument of Mr. Isherwood, but

to attest to a fact which, by an ingenious expedient adopted at the suggestion of Mr. Amory, is made obvious to the vision of any one who will take the trouble to inspect it; and which appears to be at variance with the statements above quoted. On visiting the shop at the Navy Yard, we found the steam engine which drives the works of the shop in regular operation, the furnaces being constructed on the principle of Baker's patent, with two inverted arches, as illustrated in the cut which accompanies Mr. Isherwood's statement.

For the purpose of exhibiting to view the effect produced on the movement of the flame in its passage from the fire grate through the arches beneath the boiler to the chimney, three square apertures of about 4 ins. in width, were made in one of the side walls of the furnace; one opposite to the centre of each of the arches, and one opposite to the narrow part of the furnace or flue, about three inches in height, where it passes over the sloping wall which separates the two arches. These apertures in the brick work were closed with glass, through which the movement of the flame in the furnace, at any time when it is in action, may be distinctly observed. We observed it during the regular working of the engine, the fire being fed by anthracite coal, the fire place being closed against the admission of air, except what was introduced from without by means of two iron pipes passing through the brick work at the bottom of the inverted arch nearest to the fire place, and so near its inner surface that the air so introduced must be considerably heated in its passage.

On looking through the aperture which opens upon that part of the flue between the two reversed arches, where the passage is narrowed to a height of three inches between the top of the brick work and the bottom of the boiler, a bright flame is seen to pass with a rapidity indicating a strong draft, and with the appearance of being driven horizontally by a strong gale of wind. On looking through the aperture opening to the centre of the arch nearest to the fire place, the flame is of nearly an equal brightness, but has a disturbed motion similar to the agitation of water precipitated over a dam and driven upward by its concussion with the rocks below. It seems to be a movement adapted to produce the effect described in Mr. Baker's specification of "revolving and retaining the volatile products underneath the boiler," and at the same time bringing the surface of the flame, in which the greatest degree of heat is concentrated, into immediate contact with the boiler.

On observing, by means of the third aperture, the appearance of the flame in its passage through the next inverted arch, it was found much diminished in brightness, but passing through with a disturbed and agitated movement, similar to that presented in the first arch. On throwing upon the fire grate, by way of experiment, some light wood kindlings, the brightness of the flame in this arch was very sensibly increased. From the manifest difference thus observed between the motion of the flame and the gases combined therewith, in its passage through the inverted arches, and in its passage from one arch to the other, we cannot doubt that Mr. Isherwood is mistaken in supposing that the heated gases, instead of being revolved and returned, as described in the patent, "will follow in a straight line, taking the shortest and most direct route from furnace to chimney." That the effect of the reversed arches is to pro-

duce the reverberating motion and mixing of the gases described in the patent, and consequently a more thorough combustion, appears to us manifest, from the inspection which we have here described.

NATHAN HALL,
E. H. DERBY,
Boston, November 17th, 1854. THOMAS A. DEXTER.

Translated for the Journal of the Franklin Institute.

A New Mode of Building Ships.

M. Lombo-Miraval called the attention of the *Society for the Encouragement of National Industry* to a mode of building vessels, which is entirely original. The boats, in this system, are entirely built of iron wire and hydraulic cement, and the author attributes to them the following advantages: great strength, absolute impermeability, quick repair in case of damage, perfect stability obtained by the ballast being at the bottom and making part of the hull; finally, incomparable quickness of building. A vessel built on this system six years ago, has been running ever since, without requiring any repairs, although it has gone through rough trials. Nothing easier, says M. Miraval, than to build in a few days, on board a fleet, as many gun-boats, or rafts for disembarkation, as may be wanted.

Cosmos, vol. v., p. 292.

Translated for the Journal of the Franklin Institute.

New System of Gas-Burners.

M. Ador has at length succeeded in applying his system of gas-lighting on the largest possible scale. In the immense *Café Estaminet de Paris*, he has established a great number of apparatus, furnishing together nearly six hundred candle-burners. The Ador apparatus consists essentially of a tube on which are screwed two bulbs, the one above, which is surrounded by the flame and into which the gas passes from the meter, the other below, supplied by any hydro-carbon (liquid), the surface of which the heated gas licks, and then passes out by small tubes arranged at the summit of this second ball. By this arrangement, the gas is under conditions very different from those in which ordinary burners place it. For, first, the rise of temperature which it undergoes dilates it, causes it to occupy a greater volume, and consequently brings it into contact with a greater quantity of air; the combustion is thus more perfect, and there is no longer any smoke. And, secondly, the contact with the warm hydro-carbon supersaturates the gas with carbon, or solid particles in a state of extraordinary division, and increases in a considerable proportion the brilliancy of the flame, a brilliancy proportioned to the number of solid particles in ignition. This last effect is so certain and so excellent, that when applied to pure hydrogen extracted from water, a gas which in burning gives out a great deal of heat but scarcely any light, it transforms it into an excellent lighting gas. The final result of the two modifications which common gas thus undergoes, is an economy of at least fifty

per cent.; in fact, it is established by numerous and positive experiments, that the elevation of temperature alone diminishes by one-third the quantity of gas consumed for equal light, and the effect of carburation is almost equally great.—*Cosmos*, vol. v., p. 257.

Translated for the Journal of the Franklin Institute.

New Process for Engraving on Zinc.

M. Dumont, an engraver, (*Rue Dauphine*, 17,) describes, under the name of *Zincography*, a process for electric engraving, which is promising. Upon a thick plate of zinc planed and grained with a steel tool and fine sand, he draws any subject with a kind of lithographic crayon; upon the design, when finished, he sprinkles a fine powder, mixed with resin, Burgundy pitch, and bitumen of Judea; by heating the zinc plate he melts this powder, which is converted into a varnish, and spreads over the parts of the surface which have been covered with the fat crayon, that is, on every thing which constitutes the design. To bite in the plate, and obtain the design in relief, he plunges it, while in connexion with the positive pole of the pile, into a bath of sulphate of zinc, in face of another plate connected with the negative pole; the current passes and corrodes the zinc which is not covered by the ink, and thus the design is brought out; from the plate thus engraved in relief, a gutta-percha mould is taken, in which copper is deposited to obtain the engraved plate, from which proofs may be taken by the ordinary typographic press. The process invented by M. Dumont is a new application of the principle first applied by M. Beuviére, and which M. Baldus has successfully used in his attempts at photographic engraving.—*Cosmos*, vol. v., p. 292.

For the Journal of the Franklin Institute.

Leakage of Gas-Pipes.

Will our gas-fitters believe the statement of the Abbè Moigno, that an ingenious Parisian, M. Maccaud, has *at length* found a practical method of detecting the locality of a leak in a gas-tube, which is to stop up all its known openings and pump air into it, and look or listen where it comes out. Yet this immense improvement is announced in *Cosmos* with a terrible flourish of trumpets, and we are told that "the old method was long, ineffectual, and *dangerous from the explosions which it frequently caused.* Happy Paris!

Translated for the Journal of the Franklin Institute.

New Process for Paper Making.

An excellent process for making pulp for paper and pasteboard, from wood, was invented a short time ago by M. Hartmann; this process has been perfected by M. Schlesinger, who has established a manufactury in England, where his methods have great success.

The apparatus which he uses, is composed essentially of a very strong frame of wood or cast iron, presenting an arrangement similar to that of the boxes or troughs of the grindstones used in work-shops, with the difference that the trough is circular only on one side, at its lower part, the other side being rectangular, with an opening in the angle for the drainage of the water and pulp which falls into a reservoir below, as it is produced. A mill-stone, well roughened upon its circumference, is placed on a horizontal axis resting upon two journals placed one at each side of the trough; a rotary motion is given to the axis in any of the ordinary ways, and the wheel turns like a common grind-stone.

The blocks of wood, after being cut of the proper dimensions, are placed in boxes and pressed by rods worked by counter-weights, perpendicularly to the mill-stone, so that the blocks are always in contact with the stone which tears the fibre, and in such a way that their fibres are always parallel to the circumference of the mill-stone. By this means, a pulp is obtained which is equal to the ordinary rag pulp, and cheaper. But this pulp has the property of absorbing a greater quantity of mineral substances, without lessening the strength of the paper. The pulp from hard or soft wood may be stained, and will take the most delicate tints, as well as the paste from rags.

According to the calculation of M. Schlesinger, he can produce a killogramme of *dry* pulp from wood for 10 centimes, (about $1·00 per cwt.,) and he does not doubt that in countries where wood and motive power are cheaper, he can prepare it for 7 or 8 cent. per kilog. The cheapest woods, such as the fir, pine, poplar, willow, &c., answer best for this purpose. According to the experiments made, the following articles may be advantageously made: 1st, Packing paper of the first quality, with a mixture of 70 or 80 per cent. of the wood pulp, and 20 or 30 per cent. of rags. 2d, Common wrapping paper, with 50 per cent. of wood pulp. 3d, Writing paper, from the common to the first qualities, with from 40 to 60 per cent. 4th, Wall-paper, with from 80 to 100 per cent. 5th, Card paper, 20 per cent of the wood pulp; this material is the best for making the joints of steam pipes, when it is all of the wood pulp. 6th, Printing paper for Journals, which will stand the highest temperature, from 60 to 75 per cent. 7th, Pasteboard of superior quality with 60 per cent., the quality diminishing to 100 per cent. A quality made with 75 per cent., and 25 of the rag pulp, was tried for cards for the jacquard loom, and resisted the tests of heat and dampness. —L. D'AUBREVILLE, *Cosmos*, vol. v., p. 295.

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*London Smoke. Its Use to Purify the Air.**

Justice demands that the good qualities of smoke should now be shown. In an artistic view of it, smoke is undoubtedly a great evil, because it blackens our buildings, and casts shadows upon them where there should be light; nevertheless, smoke is not an unmitigated evil; in a sanitory or chemical point of view it is very beneficial, for it purifies the air when contaminated with the poisons of malaria. Smoke, in truth, is nothing

* From the London Mining Journal, No. 995.

more than minute flakes of carbon or charcoal. Carbon in this state is like so many atoms of sponge, ready to absorb any of the life-destroying gases with which it may come in contact. In all the busy haunts of men, or wherever men congregate together, the surrounding air is, to a certain extent, rendered pernicious by their excretions, from which invisible gaseous matter arises, such as phosphuretted and sulphuretted hydrogen, cyanogen, and ammoniacal compounds, well known by their intolerable odor. Now, the blacks of smoke (that is the carbon) absorb and retain these matters to a wonderful extent. Every hundred weight of smoke probably absorbs 20 cwts. of the poisonous gases emanating from the sewers and from the various works where animal substances are under manipulation—by fellmongers, for instance, fat-melters, bone-crushers, glue-makers, Prussian-blue makers, &c. This accounts for the fact that London, although the most smoky, is yet the healthiest metropolis in the world. In waging war, therefore, against smoke, as an artistic evil, it is not wholly wise to dispense with it, on account of its sanitory value. Before we try to throw off the cloud-cap of London, we should shut off the sewers from all upward communication with the streets, and by an Act of Parliament send the bone-crushers to Salisbury Plain. As London is at present constituted, smoke is the very safeguard of the health of the population; it is unquestionably the mechanical purifier of a chemically-deteriorated atmosphere.—Septimus Piesse: *Chapel-street, Edgeware-road.*

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*New Discovery in Photography.**

One of the most promising improvements which have recently been made in the practice of photography, relates to the collodion process. A surface of collodion is well known to be much more sensitive than that of paper; but the rapidity of evaporation from it rendered it necessary to prepare it immediately before using, and thus in many cases, this process was inapplicable. For the same reason, it could not be used in those cases where the feebleness of the light required a long exposure. By the addition of nitrate of zinc, or of some other diliquescent salt, to the bath, this difficulty may be got over; for the collodion can thus be made to retain a moist surface, and therefore its insensibility for several days. Messrs. Spiuer & Crookes, who have been working out this process, recommend the following mode of dealing with the collodion plate, as having been perfectly successful in their hands:—The plate, coated with collodion, containing iodide, bromide, and chloride of ammonium, in nearly equal proportions, is made sensitive by immersion in a solution of nitrate of silver, 30 grains to the fluid ounce, and then it is transferred to a bath composed of 2 ounces of nitrate of zinc (fused), and 35 grains of nitrate of silver dissolved in six ounces of water. In about five minutes, the salt of zinc will have thoroughly penetrated the film; the plate must then be taken out, and placed upright for about half an hour on blotting paper to drain. When all the moist surface has been absorbed, it may be put aside until required for use. After exposure in the camera,

* From the London Practical Mechanics' Journal, August, 1854.

the development of the plate may be postponed, if desirable, for some days; but previous to development, the plate should be placed for a few seconds in the first-mentioned solution of nitrate of silver. Pyrogallic acid, or a protosalt of iron, may be used in the developing process.

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*Gas Tar in Horticulture.**

A discovery, which is likely to be of great advantage to agriculture, has just been reported to the Agricultural Society at Clermont (Oise). A gardener, whose frames and hot-houses required painting, decided on making them black, as likely to attract the heat better, and from a principle of economy he made use of gas tar instead of black paint. The work was performed during the winter, and on the approach of spring, the gardener was surprised to find that all the spiders and insects which usually infested his hot-house, had disappeared, and also that a vine, which for the last two years had so fallen off that he had intended to replace it by another, had acquired fresh force and vigor, and gave every sign of producing a large crop of grapes. He afterwards used the same substance to the posts and trellis works which supported the trees in the open air, and met with the same result, all the caterpillars and other insects completely disappearing. It is said that similar experiments have been made in some of the vineyards of the Gironde, with similar results. —*Galignani's Messenger.*

Translated for the Journal of the Franklin Institute.

Perfect Preservation of Milk. Method of M. Mabru.

The method of M. Mabru, by which milk is preserved without withdrawing from it any of its essential elements, without reduction of volume, addition of any foreign element, or coloration, consists in withdrawing from it the dissolved gases, air, oxygen, and carbonic acid, by raising its temperature, not in contact with air, as in Appert's process, but in an atmosphere of the vapor of water, then inclosing it in a vessel entirely full of it, out of contact of any gas. M. Mabru, in his present establishment, operates upon six quarts of milk at once; he places the milk in four long tinned or enamelled iron bottles, terminated by lead tubes, about four inches in length. He inserts the leaden necks of the bottles into a prismatic box, and fixes them firmly by screws. He establishes this box, and the bottles hanging from it, above a chamber with metallic walls communicating with a steam boiler; by means of a funnel he pours milk into the box until it covers the mouths of the bottles a half inch or more; he then closes the box and the chamber, heats the boiler until the tube is filled with steam at 212° Fahr., and thus raises the temperature of the milk in an atmosphere of steam. He continues thus to heat from three-quarters of an hour to an hour; he then removes the box with its bottles, and cools them in a vessel of cold water while the layer of milk still covers the mouths of the tubes; when they are cold, he removes each

* From the London Farmer's Magazine, October, 1854.

bottle, flattens the mouth of the lead tube with a pair of strong pincers, and thus closes, hermetically the bottles, filled with milk and devoid of gas. They may then be sent any distance, and in any way, without danger from internal shaking, without any possibility of forming butter, and, at least in the majority of cases, without any danger of alteration. Only the cream gradually separates, rises to the top, and thickens in the lead tube, remaining, however, perfectly pure.—*Cosmos*, vol. v., p. 325.

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*Turkish Recipes for Hydraulic Mortar and Cement.**

As the aqueducts of Constantinople are attracting additional notice the more they are studied and examined, being astonishing works (especially if we take into account the infant state of chemical and manufactorial science of the Turks,) the following recipes will be found of interest, and deserving of examination and trial. It is, moreover, a curious fact, that other semi-barbarous nations, also, are in the possession of mechanical procedures and contrivances, inaccessible even to European science and art; as, for instance, the art of the Chinese to unite (solder) cast iron, &c.

Lime Mortar.—It is prepared with fresh water, and mixed with two parts of powdered lime (*Staub Kalk*) and one part of river sand.

Hydraulic Mortar.—Bricks are pounded until the grains attain the size of common river sand, and one part of the brick powder is mixed with two parts of powdered lime, and the necessary quantity of fresh water. In using this mortar a layer of mortar is placed between the bricks or courses of bricks, of the *same* thickness as the brick, which must have been previously soaked in water; the latter is not to be neglected.

Hydraulic Cement, for the internal dressing (*Putz*) of arched aqueducts, cisterns, baths, and generally all constructions through which water flows or is kept in. Take 100 *ocka* (of $2\frac{1}{4}$ lbs., of 16 ounces,) of fluid lime, and 4 *kilots* (at 22 *ockas*) and 2 *ockas* of very minutely-plucked tow (*werg*,) which is to be distributed very accurately throughout the mass. If these two ingredients have been duly mixed and worked up, the mass thus obtained has to remain quiet during at least eight days, that the tow may have time to combine thoroughly with the lime. If the mortar is to be used, it is again to be well stirred up, and is to be spread with a small trowel; and after this first operation has been performed, the dressing (*Putz*) is yet to be rubbed gently but repeatedly with the trowel, until the surface is quite smooth and plain. For the sake of protecting it still more from the action of the water, and to make it durable for a long time, it is then to be coated by a putty (*Oelkitt*,) which is called *lukin*, and is thus prepared. To 100 *ocka* of freshly burnt lime, which has become converted into dust, 25 *ockas* of the best linseed oil are added, as well as 20 drachms (1 *ocka* = $2\frac{1}{2}$ lbs. = 400 drachms) of rough cotton. The lime is to be worked and mixed in a wooden chest or trough, while the linseed oil and the cotton are added in succession, until the mass has obtained the consistency of dough. This mass is preserved, making of it large pieces resembling loaves of bread. If it is to be used, it is stirred

* From the London Mechanic's Magazine, October, 1854.

up with linseed oil, until it becomes fluid, and fit to make a coating, which is painted over twice or thrice. In employing it for lead water-pipes, it is thus used. The lead pipes are made of a length of 0·65 *m*, and first cemented in the whole length, only at the other end, 0·16 *m*, is left free for being able to unite them. If two of these pipes are to be united, one of the ends of the pipes is cut perpendicularly into several pieces with a hand-saw, and they are bound around in the shape of a funnel. We then take some well combed long threaded hemp, soak it with lukium, and cover with it the end of the pipe, A, which is to be united to the pipe, B, in such a way that the hemp bundles (*Hanfstrange*) lie close to each other; but, at the same time, these envelopings are to be so arranged that only one-half of the length of these hemp skeins has been employed. The end of the pipe, A, thus prepared, is then placed in the funnel-shaped end of the pipe, B; and the cut asunder portion of the pipe end, B, is then to be compressed by the remaining portion of the hemp. This envelope, as it were, of hemp is then tied over with a string of about 3 lines diameter, in such a way that the threads lie close to each other. If these cements have become dry, they acquire the hardness of stone, resist all moisture, and possess an indestructible durability. If the pipes lie in an ascending position, two such cementations are to be made, for obtaining an adequate resistance; for those lying in the ground, one is sufficient. The pipes thus united are placed in small drains, supported at intervals, for avoiding this bending, and surrounded by mortar mixed with brick-dust. If the pipes treated in that way have a large diameter, the whole is to be well dried before the water is let in, a precaution unnecessary with small pipes.

Translated for the Journal of the Franklin Institute.

Analysis of Milk.

M. le Docteur Leconte, Adjunct Professor in the Faculty of Medicine, proposes a new process for the analysis of milk, founded upon the determination of the quantity of butter which it contains. As it is proved that the other elements of milk, the sugar and the albumen, obey the same fluctuations as the butter, M. Leconte thought that it would be sufficient to determine this latter element.

His apparatus consists of a tube closed at one end, of about $\frac{8}{10}$th inch in diameter, and divided into five parts, each having a capacity of two cubic inches; to the upper part is attached another of much smaller diameter, and divided into twentieths of a cubic centimetre; finally, at the upper part of this latter tube is another like the lower, but much shorter, and without divisions; this serves as a funnel and receives the liquids which dilate during the operation.

When we wish to make an analysis, two cubic inches (of milk) are measured into the lower tube, and eight cub. inches of crystallizable acetic acid are added; then, after closing the upper orifice of the tube with a glass disk or stopper, the apparatus is shaken for some minutes; the caseine, at first coagulated by the acid, gradually re-dissolves, and the butter rapidly rises to the top in white flakes; it is enough, then, to

heat with an alcohol lamp to melt the butter which forms a liquid stratum, the volume of which is easily measured by the divisions of the smaller tube in which it lies.—*Cosmos*, vol. v., p. 395.

For the Journal of the Franklin Institute.

Particulars and Performance of the Steamer North Carolina. By J. VAUGHAN MERRICK.

Philadelphia.—Hull built by Vaughn & Fisher; Machinery by Merrick & Sons; Owner, Alexander Heron, Jr. Intended Service, Philadelphia to Wilmington, North Carolina.

HULL.—Single decked, with poop cabin.

Length for tonnage,		172 feet.
Length on deck,		176 "
" deep load water line,		170 "
Greatest breadth at deep load line,		33 " 4 inches.
" " main wales,		32 " 2 "
Depth of hold,		12 " 4 "
Length of engine and boiler space,		34 "
Draft of water at deep load line,		10 "
Tonnage, custom house,	672	
Area of immersed section at 9 ft. 3 ins. mean draft,		249 square feet.
Contents of bunkers in tons of coal.	90	
Masts and rig—Three masts; foremast square rigged; heavily sparred and canvassed.		

ENGINE.—One—Vertical square.

Diameter of cylinder,	56 inches.
Length of stroke,	4 feet.
Maximum pressure of steam in pounds,	25
Cut-off,	Variable from $\frac{1}{4}$ to $\frac{1}{7}$.
Maximum revolutions per minute,	29 to 30 of engine.
Gearing,	1 to $2\frac{3}{4}$, giving $77\frac{1}{2}$ to 80 of propeller.

BOILERS.—Two—Return tubular.

Length of boilers,		13 feet 3 inches.
Breadth "		9 " 7 "
Height " exclusive of steam drum,		10 "
Height " inclusive " "		19 "
Number of furnaces, in all,	8	
Breadth of furnaces,		1 " 9 "
Length of grate bars,		7 " 3 "
Number of flues or tubes, in all,	324	
Internal diameter of flues or tubes,		3 "
Length of flues or tubes,		8 " 3 "
Heating surface, in all,	3010 square feet.	
Diameter of smoke pipe,		4 " 11 "
Height, " "	54 feet above grate.	
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour.	1500 lbs., estimated.	

PROPELLER.—True screw, of cast iron.

Diameter,		9 feet 3 inches.
Length,		2 " 9 "
Pitch,		16 " 6 "
Number of blades,	3	

Remarks.—This ship possesses the largest freighting capacity of any steamship of her tonnage in the U. S. Marine. She was modelled by Mr.

John W. Griffiths, Marine Architect, and was intended for a freight ship with very light draft. With 350 tons dead weight, in addition to her coal for six days' steaming, she will draw but 10 feet on an even keel.

The fore body rises from midship section, so that her real draft from base line, measured on the forward, perpendicular, is three feet less than by marks. She has full after-water lines and amidship section aft of the centre of length.

The engine is a vertical square condensing engine, having its cross-head overhead, and two side rods attached to crank pins in the driving spur wheels, the crank shaft being beneath the cylinder bottom. On the opposite side of the propeller shaft is a tubular condenser; the main and fresh water air pumps and other pumps, are outside of it, worked by boiler plate side levers attached by links to the cylinder cross-head. The valves are equilibrium poppets, with Allen & Wells' adjustable cut-off on steam side. The gearing is of iron, with shrouding to the pitch line: wheels, 6 ft. 4 ins. diameter, and 2 ft. 8½ inches diameter of pinion; 10 ins. face of teeth on each set.

On the trial trip, the propeller was not nearly submerged, being 1 ft. 7 inches out of water; draft aft, 8 ft. 2 ins.; draft forward, 7 ft. 7 ins. Bunkers filled, but no freight in. The boilers made abundance of steam for 29 revolutions of the engine, while indicator cards showed an initial pressure in the cylinder of 25 to 26 lbs., cut-off at three feet, or ¾ stroke.

On the first trip of the ship, her performance down the river, as far as Newcastle, was noted, and is given below; owing to the floating ice in the river, the ship was not driven, a pressure of 21 pounds only being maintained in the boilers, cut-off at 18 inches, or ⅜ths of the stroke only. From the speed then attained, (10 miles per hour,) it is probable that at least 11½ miles per hour may be obtained with full *steam pressure*, in still water.

Performance on First Trip.—Draft of water aft, 10 feet; forward, 8 feet 6 inches; with 150 tons freight, beside 90 tons of coal in the bunks.

Passed	Time.		Whole distance.		Registered revolutions.		Revs. per mile.		Steam.	Vacuum.	Cut-off in Ins.
	H's.	Running.	Apparent.	Actual.	Whole.	Nett	Engine	Propeller.			
Navy Yard,	10·20				477				14		18
Chester,	12·	1·40	16·50	17·00	2870	2393	140·8	375·4	20	26½	18
Marcus Hook,	12·55				3853				21		18
Newcastle,	2·45	1·50	14·50	18·50	6600	2747	152·5	406·7	21	26½	18
Means,							146·6	391·5			

The actual distance is known by applying a correction for tide, which was adverse except for about four miles.

The particulars from Chester to Marcus Hook are not noted, owing to time, &c., lost in landing a passenger.

The average revolutions per mile run by the ship, were 391½ of the propeller, equal to its advance through $391\frac{1}{2} \times 16\frac{1}{2} = 6459$ feet.

The slip was, therefore, $6459 - 5280 = 1179$ feet $= 18\frac{1}{4}$ per cent. The average revolutions per minute, with 19 pounds steam, cutting off

at $\frac{3}{8}$ths stroke, from Navy Yard to Chester, were 23·93, and with 21 lbs. at $\frac{3}{4}$-ths stroke, from Marcus Hook to Newcastle, were 24·88.

The propeller shaft has a slip clutch, by which the propeller may be disengaged when the ship is under sail.

The engineer's department of this ship is provided with every convenience. A Worthington steam pump is attached for putting out fires, washing decks, pumping bilge, or feeding boilers; it has an auxiliary steam boiler on deck by which it may be worked in port. The thrust bearing of the shaft has Parry's anti-friction conical rollers, which worked well so far as heard from.

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*On an Improved Construction of Moulds for Casting Metals.**

The subject of this paper is the invention of Mr. John Jobson, of Derby, and may perhaps be considered as one of the results of the difficulty experienced in the labor market. This invention consists of a mode of constructing the moulds for metal castings, by means of which the process of moulding is simplified, and an important economy effected in the cost and time of moulding; also the accuracy and perfection of the moulds is increased, so that the castings produced have less "fin" or other irregularities than usual, and greater uniformity is insured in running the metal, than in the ordinary method of moulding, reducing the proportion of "wasters."

The advantages of the new plan are most felt in the cases where a large number of castings have to be made from the same pattern; also where the more intricate form of the pattern (as in foliage or ornamental castings) makes it difficult to draw from the sand in the ordinary process of moulding, and the irregular surface of the "parting" or separation between the moulds increases the difficulty of making a clean casting, free from "fin," and also involving considerable time and skilful labor, which has to be repeated for every casting.

In the new process of moulding (the subject of the present paper,) after the pattern has been first partially imbedded in the sand of the bottom box (as in ordinary moulding,) and the parting surface accurately formed, the top box is then placed on, and is filled with plaster of Paris, or other similar material, to which the pattern itself adheres. When the plaster is set, the boxes are turned over, the sand is carefully taken out of the bottom box, and a similar process repeated with it,—using clay-wash to prevent the two plaster surfaces from adhering. This forms a corresponding plaster mould of lower portion of the pattern. These two plaster moulds may be called the "waste blocks," as they are not used in producing the moulds for casting, but are subsequently destroyed.

Reversed moulds, in plaster, are now made from these waste blocks (the pattern being first removed,) by placing upon the bottom box a second top box, an exact duplicate of the former top box, and filling it up with plaster (having used clay-wash as before,) and doing the same with the other box. Reversed moulds are thus obtained, from which the final sand moulds for casting are made, by using them as "ramming-blocks,"

* From Lond. Journ. and Rep. Sci., Nov., 1854.

upon which the sand forming the mould is rammed, by placing a third duplicate top box upon the ramming-block, and a corresponding bottom box upon the ramming-block.

The requisite "gits," "runners," and "risers," are formed previously in the original sand mould, and are consequently represented in the ramming-blocks by corresponding projections or ribs upon the parting face of the one, and hollows in the other, (which are then stopped up with plaster,) and these are properly repeated in the final sand moulds; these last, therefore, when put together, form a complete mould for casting, just like an ordinary sand mould, but having some important advantages.

Any number of succeeding moulds can be made from the original ramming-blocks by the simple process of ramming, without any handling of the pattern or turning over the boxes; both top and bottom moulds being rammed independently, and at the same time, if desired. The parting being once accurately formed in the original mould, all the succeeding ones are necessarily correct, without any further care being required; and by carefully trimming the original, and slightly paring down the inner edges of the parting faces, if requisite, the faces of the final sand moulds have a corresponding fulness, and are readily adjusted, after the first trial, to fit so closely together, that practically no fin is left on the castings, as shown by the specimens before the meeting, which are all of them just in the state in which they left the sand, never having been dressed or trimmed. Also, the labor of forming the gits and runners afresh for each casting mould is avoided, by having them completely imprinted upon each mould in the process of ramming; and by this means all the risk is avoided of imperfect castings arising from want of uniform care or judgment in the formation of the gits, &c., by the moulder in the ordinary process. This is the more important in the case of difficult castings, where several trials may be required before the best mode of running the metal is ascertained, so as to insure sound, good castings; and by this process the exact repetition of the same plan is insured, without requiring any further attention from the moulder.

A small hollow is imprinted in the ramming-block for the top box, into which the plug for forming the git is rested whilst the box is rammed; and by this means the git is insured being formed in the right place, without any care on the part of the moulder.

When the pattern is long and very thin and intricate (as in the case of an ornamental fender front,) where the general surface is also curved or winding, the difficulty of picking out the pattern from the mould is so great as to require the most skilful workman; and the length of time required for repairing the injuries of the mould, causes about eight sets of fender castings per day to be the general limit to the number that can be moulded by one man and a boy. But however difficult the pattern may be to mould in the ordinary way (if it is arranged to "draw" properly from the mould,) with the new process the labor is very little greater than with an easy pattern, and the saving of time is so great that as many as 30 per day are moulded on the average by one laborer and boy.

When the pattern is slender and long, it is liable to be broken in the frequent handling to which it is subjected in the ordinary process of moulding, and the expense and delay caused by breakage of patterns is

of serious consequence in light ornamental work; but in the new plan this is entirely avoided, as the pattern is never handled except in the first process of moulding, to form the ramming-blocks.

When the face of the castings is required to be particularly well finished (as in the case of ornamental work) a brass or other metal pattern is made, and is dressed up and finished to the degree that may be desired in the castings, and any chasing or other additional ornament put upon it; then, after forming the ramming-block for the bottom box by a plaster cast from the pattern, in the manner before described, the pattern itself is made to form the permanent face of the ramming-block for the top box, by leaving it in the mould when the plaster is poured in; so that the plaster forms merely the parting face, and a solid back to the pattern. In this case the iron pattern is secured to the cross bars of the box by several small bolts screwed up to plates at the back of the box; so that, when the plaster is poured in, filling up the whole vacant space of the box, and setting solid around these bolts and over these nuts, the iron pattern becomes so firmly secured in the box, that no ramming or moving to which it is afterwards subjected will loosen it.

In this plan the mould for the face of every casting is formed from the original metal pattern, and the pattern itself is firmly and permanently secured in the plaster bed; so that, however thin and delicate it may be, there is no risk of injury to the pattern, in moulding any number of castings;—as many as 3000 have been cast without injury from a slender ornamental pattern.

In forming the ramming-blocks, common plaster of Paris is generally employed, as the most convenient and economical material; and this is found to be sufficiently durable for general work. The blows of the rammer are deadened by the sand in the box, and do not fall directly upon the plaster block,—so that there is no risk of injury with ordinary care in ramming. As many as 4000 castings have been moulded from one pair of plaster blocks; but when a greater number of castings is required from one pattern, or when the size or nature of the mould renders a harder face advisable, a metal face is employed for the ramming-block of the bottom box, or for the parting surface of one or both blocks. This is formed simply by running into the mould, when prepared for the plaster, a small portion of metal, consisting of zinc, hardened with about $\frac{1}{15}$th part of tin; sufficient metal being used to form a strong plate for the surface of the ramming-block, and the rest of the space at the back filled with plaster as usual. In practice it is more convenient generally to reverse the mode of running this metal for the face of the mould, by first ramming the box, when prepared for the plaster, full of sand, then lifting it off, and paring off the surface of the sand wherever the metal is wanted to such depth (about $\frac{3}{8}$ of an inch) as may be desired for the metal; and when the box is replaced in its former position, the metal is run in, filling up those spaces where the sand has been cut away. The sand in the upper box at the back of the metal face is then all removed, without moving the box (part at a time if requisite), and plaster poured in above to fill up the box and make a solid back as before.

The metal face is firmly secured to the plaster back by several small dovetail blocks cast upon the back of the metal, by cutting out corres-

ponding holes in the sand mould before the metal is run in. Various modifications of this plan of construction are employed, according to circumstances, for economy or convenience; and sometimes the face of the ramming-block is partially covered by separate pieces of metal; but, in every case, the entire face of the two ramming-blocks forms a perfect counterpart of the intended casting (half being represented upon each,) surrounded by parting faces which exactly fit one another, because the one has been moulded from the other.

Where the pattern is long, and a metal face is employed, a narrow division is made, subdividing the metal face into two or more lengths, to allow for the shrinking of the metal forming the face,—the effect of which is then found to be imperceptible. The plaster ramming-blocks are varnished when dried, to preserve them from damp; and, in moulding from them, the faces of the blocks are dusted with rosin, to prevent adhesion of the sand.

The new process of producing the blocks, though somewhat complicated in description, involves practically but little increase of work over the process of moulding required for the first casting produced by the ordinary method; but every subsequent casting, instead of requiring a repetition of the whole process of the first moulding, as in the ordinary method, is moulded by simply ramming the boxes upon their respective blocks. The ordinary "odd side" boxes are used for this purpose,—all that is requisite being that every top box fits steadily and securely upon every bottom box, so that they may be interchanged in the process of forming the ramming-blocks, without disturbance of the relative position of the pattern. An improved form of the steady pins for connecting the top and bottom boxes has been adopted. Instead of four or more round pins fixed on the bottom box, and fitting into corresponding holes in lugs cast upon the top box, vertical angular studs are cast on each bottom box, and fit against corresponding projections on the edge of the top box. The only fitting required in making the boxes is to file the touching angles of the pins, so as to fit one standard top box; the projections on the top boxes being all fitted to one standard bottom box.

It has to be noticed, that in the ordinary plan of moulding, and by the "odd side" and "plate" methods, one side of a pattern is not available while the other is in use. By the new process, each pattern is equal to two, as it will be evident that both blocks may be worked from at the same time.

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Mr. Jobson exhibited a number of specimens of castings rough from the mould, to show the unusually small amount of fin upon them, and the good quality of the castings obtained by the new process of moulding. Also several of the plaster ramming-blocks were exhibited of the different kinds, and a pair shown in operation, showing the quickness of the process of moulding from them, and the perfection of the sand moulds obtained.

The Chairman thought the process was certainly very efficient in insuring expedition and accuracy, and the moulding was remarkably perfect; there must be an important economy both in the cost of moulding

and in the cost of dressing the castings, which were turned out remarkably clean and free from fin.

Mr. Jobson said that in the ornamental castings the dressing formerly cost as much as £10 per ton, from the fin left in the old process of moulding; but this expense was now mostly saved, as there was practically no fin left with the new plan. The specimens exhibited showed the ordinary average work produced; and the castings were just in the state in which they left the mould, not having had any trimming or dressing. For particularly fine work a sulphur face was used for the ramming-block instead of plaster; a small thickness of sulphur being first run on to form the face of the block, like the metal facing used in those blocks from which a very large number of moulds was required to be rammed.

In answer to an inquiry, he stated that the largest size of casting at present moulded by the new process was about 3 feet 6 inches square, and 8 ft. by 1 ft. With large castings there was seldom perhaps a case of a sufficient quantity from one pattern, or it might be advantageous to apply the plan.—*Proceedings of the Institution of Mechanical Engineers, Birmingham.*

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*The Boilers of the Arctic.**

Mr. Prosser read a paper on surcharged steam, in which he commented particularly on the construction of the boilers of the *Arctic*, which had just left Liverpool on its last voyage. The main object of the paper was to show that the great source of difficulty and danger in the use of steam is to be found in its high temperature rather than in its high pressure, and that, consequently, all other things being equal, that medium which requires the highest temperature to produce a given pressure is the most difficult and dangerous. In the boilers of the *Arctic* the plan was adopted of giving additional heat to the steam after it was generated, and that plan Mr. Prosser contended is defective in principle and causes a greater consumption of fuel. To accomplish the heating of the steam, a portion of it was passed through wrought iron pipes, which were placed within the furnace of the boilers, and after being heated by coming in contact with it, the steam was reunited with the other portion which had not been so heated, and then passed into the steam chest and cylinder. The tubes of wrought iron, 5 inches in diameter externally, were placed horizontally fore and aft in each furnace, one on each side; the lower ones communicating with the upper ones by other tubes placed vertically of the same diameter, and united by malleable cast iron elbows.

The principle of using heated steam is no novelty, as it had been put in practice by Watt, and abandoned as useless. Numerous other persons had since revived the plan as new, and had endeavored by fallacious experiments to prove its advantages; but Mr. Prosser contended there is loss, and no gain whatever, in heating the steam. He alluded particularly to the experiments and calculations which had led to the determination of introducing the "mixture" of steam and heated steam into the system of the *Arctic*. The experiments and calculations referred to are

* From the Lond. Civil Eng. and Arch. Journ. Nov., 1854.

detailed in the *Journal of the Franklin Institute* for the current year. They were compiled by Mr. Isherwood, from the notes of Mr. Martin. The experiments were intended to prove the advantages of "surcharged" over "normal steam," and of the "mixture" over both when applied to steam engines, whether condensing or not. A very little reflection, however, would show that, if any thing at all is proved, it is the exact contrary to the inferences drawn therefrom. High pressure steam had been limited in its application by a sense of danger, but a far greater one is involved in its high temperature, and in these very experiments it is recorded that the felt covering of the steam pipe was burned.

The *Arctic* had been fitted up with sixteen double furnaces in four boilers. Each double furnace worked into one tube chamber, and had an aggregate recipient heating surface of about 1000 feet through which to transmit about 1000 degrees of heat to the water in the boiler, and thus convert it into steam. The steam heaters in each double furnace exposed about 50 feet to the direct action of the fire, and he had assumed the additional heating surface at 5 per cent. of the whole which the boilers previously had. The average pressure used was about 16 lbs. above the atmosphere. The density of the steam would, therefore, be about $\frac{1}{858}$th as compared with water, and this addition might increase the density, if applied in the ordinary way, by about 5 per cent., the corresponding increase of elasticity to which is 2 lbs., or, in other words, we may calculate upon a gain of about 7 per cent. by a consumption of fuel equal to 5 per cent. only, or four tons per day, taking the ordinary present consumption at 80 tons per 24 hours. It is not, however, proposed to apply the heat thus, but to the heating of the steam. Now, as steam has but about one-quarter the specific heat of water, it follows that the same amount of heat cannot be extracted by the steam, or by water, from the additional surface in the same space of time. Even in the impossible supposition of the density of the steam being the same as water, the rate of absorption can be but one-quarter, or equal to the specific heat of the steam, as compared with water, and requiring, therefore, the combustion of 1 ton instead of 4 tons of coal per day, that being all that the steam will take up. But the density of the steam, if taken only at 1·800 that of water, and half of the whole which is generated is made to pass through the steam heaters, it follows that the velocity must be 400 times greater than would be necessary in the case of water being substituted for the steam to be heated.

Mr. Prosser said he had endeavored to show, first, that these experiments are of no value whatever, because they meet no possible case, and, secondly, that the addition of 5 per cent. of recipient heating surface to a boiler will be far more efficacious when applied in the ordinary way to the evaporation of the water, and consequent increased tension of the steam, than to the heating thereof. The whole operation in either case is merely mechanical, although many have attached to it a mysterious action, a sort of mechanical catalysis, very difficult indeed to understand, and still more so to explain in any rational manner.

The great advantage of using water as the medium consists in its great density as compared with its vapor; and this also, together with the enormous amount of latent heat in its vapor, is a great source of safety, as it

avoids the danger attendant upon a sudden increase of heat, by absorbing it without the production of that fearful state of attenuation of the metal which the repeated overheating of it must inevitably produce, to say nothing of the diminished strength by a slight increase over the usual temperature employed in the steam heaters. Steam is instantly condensed by coming in contact with any thing colder than itself, and hence arises enormous loss and waste, the avoidance of which appears to have led many to the belief that using heated steam is the proper remedy for this great defect. A remedy it certainly is, and one simple enough, but beset with difficulties and dangers which few are aware of, and far exceeding any other known method of using steam, however high-pressure it may be. In conclusion, Mr. Prosser suggested the use of high-pressure steam, worked expansively, and condensed without a vacuum, for ocean steamers. High-pressure steam, he said, is always dry when worked expansively under ordinary circumstances; and when, in addition to that, the working cylinder has a steam jacket, it is more than probable that far greater economy will be attained, without increase of danger, than by any system of "surcharged steam" it is possible to devise —*Proceedings of the British Association for the Advancement of Science.*

On Magneto-Electricity and Under-Ground Wires, as applied for Telegraphic Purposes.

In a paper on the above subject, Mr. Edward Bright said:—Magneto-electricity, as well known, is the current induced in a coil of wire when moved before the poles of a permanent magnet, a positive current being manifested at one end of the coil, and a negative current at the other, upon any movement of the coil before the poles. The greatest development of induced currents occurs when the coil is electro-magnetic (the helix of wire wound upon a soft iron core.)

As applied to telegraphic purposes, the iron core of the coil, when at rest, partly serves as a keeper to the magnet, though not actually in contact with the poles; and when worked by a key attached to the axle, the coil moves freely before the magnet, generating a current with each change of position, which is applied to actuate indicators or ring bells at a distance. This principle constitutes the system of the Magnetic Telegraph Company; all other companies in this kingdom and America have adopted the galvanic battery.

The generating magnets have remained unimpaired in strength during three years of constant use (a period in which a dozen consecutive series of voltaic batteries would have been worn out.)

The magnetic currents thus generated can be passed through subterranean wires, to a distance of 660 miles (the utmost extent of such conductors in England,) without any break or renewal of circuit.

The return (or recoil) current from underground wires, which has interfered with the working of other telegraphs, is applied in the magnetic apparatus to assist in working it; being made to keep the indicating needles at zero until actuated from a distant station.

* From the London Mechanics' Magazine, October, 1851.

A remarkable feature in underground wires is the small comparative velocity with which the electric sensation passes through such conductors. Professor Wheatstone's experiments on a short length of wire in a room have demonstrated that *frictional* electricity passes at nearly 300,000 miles per second; (this variety cannot, however, be practically applied for telegraphic purposes.) Professor Walker's (America) give the speed of galvanic electricity through overground telegraph wires at only 16,000 miles per second; while, lastly, experiments conducted by the engineer of the Magnetic Company and myself, on an underground length of about 500 miles of gutta percha covered copper wire, show that the transmission of galvanic or magnetic currents through such conductors varies from 960 to 1700 miles per second, according to the intensity of the current employed.

This diminution in velocity, as regards the underground wires, is intimately connected with the recoil current recently analyzed by Dr. Faraday, and proved as due to the analogy between such conductors and a Leyden jar, the electricity communicated being temporarily absorbed by the wire until the mass of copper is saturated with electricity; hence retardation ensues.

From the foregoing, I deduce that the speed with which electricity passes varies with the energy (that is, intensity,) of the current employed, and also with the nature or conditions of the conductor interposed through which it passes.

Underground wires are only affected by terrestrial electricity, when a flow takes place from *one district* of the earth's surface to *another;* while *overground* wires are also subjected to the action of perturbative currents whenever the electrical *status* of the atmosphere changes as regards the earth—principally during the rising or falling of the dew—*aurora borealis*, &c.

In the *Quarterly Review* for June, 1854, a very unjust and erroneous comparison is instituted between the English and American scale of charges for telegraphic messages, the American rate being stated to be about one-tenth that of this country.

To correct such a statement, which is calculated seriously to prejudice the English companies with the public, I should mention that considerably prior to the publication of the *Review* the charges in England were considerably lower than in the United States; and that instead of the cost of a message of twenty words between Louisville and Pittsburgh being 20 cents, or 10d., the American charge (as proved by the tariff of the American Telegraph Confederation, published at New York, in April last,) was 3s. 6d.; while the English rate for a similar message, transmitted an equal distance, was 2s. 6d. And in another case the *Quarterly* states the charge between New York and New Orleans to be 2s. 7d. for ten words, whereas the charge is 10s. The economy of system claimed for America does not exist, but the advantage is on the English side. The lecture was accompanied and illustrated by experiments.

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